2. Remove temporary protective coverings and strippable films as metal shingles are installed unless otherwise indicated in manufacturer's written installation instructions.
3. On completion of installation, clean exposed surfaces of metal shingles according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Remove excess sealants. Maintain metal shingles in a clean condition during construction.
4. Remove excess metal shingles and debris from Project site.

END OF SECTION 07 31 16 00

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SECTION 07 31 26 00 - SLATE SHINGLES

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Slate shingles.
b. Underlayment.
c. Snow guards.

C. Definitions
1. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals
1. Product Data: For each type of product indicated.
2. Samples
a. Slate Shingle: Full size, of each color, size, texture, and shape.
b. Ridge Cap **OR** Vent, **as directed**: 12-inch- (305-mm-) long Sample.
c. Fasteners: Three fasteners of each type, length, and finish.
d. Exposed Valley Lining: 12 inches (305 mm) square.
e. Snow Guard: Full-size unit **OR** Base, bracket, and 12-inch- (300-mm-) long rail, **as directed**.
3. Warranty: Sample of special warranty.

E. Quality Assurance
1. Source Limitations: Obtain each color of slate shingle from single quarry capable of producing slate of consistent quality in appearance and physical properties.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty
1. Special Warranty: Standard form in which roofing Installer agrees to repair or replace slate roofing that fails in materials or workmanship within two **OR** five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Slate Shingles
1. Slate Shingles: ASTM C 406, Grade S1 **OR** Grade S2, **as directed**; hard, dense, and sound; chamfered edges, with nail holes machine punched or drilled and countersunk. No broken or

cracked slates, no broken exposed corners, and no broken corners on covered ends that could sacrifice nailing strength or laying of a watertight roof.

a. Thickness: Nominal 3/16 inch (5 mm) **OR** 3/16 to 1/4 inch (5 to 6 mm) **OR** 1/4 to 3/8 inch (6 to 10 mm) **OR** 3/8 to 1/2 inch (10 to 13 mm), **as directed**.
b. Surface Texture: Smooth **OR** Rough, **as directed**.
c. Size: 24 inches (610 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
d. Size: 22 inches (560 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
e. Size: 20 inches (510 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
f. Size: 18 inches (455 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
g. Size: 16 inches (405 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
h. Size: 14 inches (355 mm) long by 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** 7 inches (180 mm) **OR** random widths, but not less than one-half-length, **as directed** wide.
i. Size: 12 inches (305 mm) long by 12 inches (305 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** 7 inches (180 mm) **OR** 6 inches (152 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
j. Size: 10 inches (255 mm) by 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** 7 inches (180 mm) **OR** 6 inches (152 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
k. Nail Holes: Two **OR** Four, **as directed**, per shingle.
l. Butt Shape: Standard square cut.
m. Cut Butt Shape: Standard square cut and pointed **OR** deep bevel **OR** shallow bevel **OR** deep scallop **OR** shallow scallop **OR** round, **as directed**.
n. Color: Black **OR** Gray **OR** Purple **OR** Green **OR** Blue black **OR** Blue gray **OR** Mottled purple and green **OR** Red **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
o. Weather-Exposure Color Change: Unfading **OR** Weathering, **as directed**.

2. Starter Slate: Slate shingles with chamfered nail holes front-side punched.
   a. Length: Exposure of slate shingle plus head lap.
3. Ridge Slate: Slate shingles fabricated with vertical **OR** horizontal, **as directed**, grain orientation.

B. Underlayment Materials
1. Felt Underlayment: ASTM D 226, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt, unperforated.
2. Felt Underlayment: ASTM D 2626, asphalt-saturated and -coated organic felt, mineral surfaced, unperforated.
3. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
4. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
5. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 30- to 40-mil- (0.76- to 1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or

SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.

a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

C. Snow Guards
1. Snow-Guard Pads: Fabricated copper **OR** cast-bronze **OR** zinc **OR** stainless-steel **OR** aluminum, **as directed**, units, designed to be installed without penetrating slate shingles, and complete with predrilled holes or hooks for anchoring.
2. Snow-Guard Rails: Units fabricated from metal baseplate anchored to adjustable **OR** fixed, **as directed**, bracket and equipped with two **OR** three, **as directed**, bars.
   a. Brackets and Baseplate: Aluminum **OR** Bronze or brass **OR** Stainless steel, **as directed**.
   b. Bars: Aluminum, mill finished **OR** Aluminum, clear anodized **OR** Stainless steel, mill finished, **as directed**.

D. Accessories
1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed**, polymer sealant; of type, grade, class, and use classifications required to seal joints in slate-shingle roofing and remain watertight.
4. Slating Nails: ASTM F 1667, copper, **OR** aluminum-alloy, **OR** stainless-steel, **OR** cut-brass, **as directed**, smooth shanked, wire nails; 0.135-inch (3.4-mm) minimum thickness; sharp pointed; with 3/8-inch- (10-mm-) minimum diameter flat head; of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.
   a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
5. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire nails with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
6. Wood Nailer Strips and Eave Cants: Comply with requirements in Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.
7. Ridge Cap **OR** Vent, **as directed**: Custom-fabricated metal covers with noncorrosive components complete with internal anchoring lag screws, compression plates, and snap-on caps and slate retention channels, **as directed**.
   a. Type: Cap, nonventilating **OR** Vent, with ventilating mesh providing net-free area of 18 sq. in./ft. (380 sq. cm/m) **OR** Vent, with ventilating mesh providing net-free area of 18 sq. in./ft. (380 sq. cm/m) and external baffles, **as directed**.
   b. Metal Components: Copper, 20-oz./sq. ft.- (0.7-mm-) thick sheet **OR** Aluminum, 0.050-inch- (1.3-mm-) thick sheet, with manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin on exposed surfaces, **as directed**.
   c. Accessories: Splices, end caps, and other accessories of matching metal and finish.
8. Track- and Clip-Attachment System: Custom-fabricated slate-shingle attachment system designed for use with notched-slate shingles consisting of extruded-aluminum, **OR** formed stainless-steel, **as directed**, perforated Z-track, screws, and spring clips for anchoring slate to roof deck.

E. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.

2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
   a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope slate shingles and 6 inches (152 mm) up the vertical surface.
   b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
   c. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope slate shingles and 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.
   d. Hip Flashings: Fabricate to length of slate shingle and to extend 3 inches (75 mm), **as directed**, beyond joint of hip shingle with adjoining roof shingle.
   e. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile at center of valley and equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
   f. Closed-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) and equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
   g. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation
1. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
   a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
   a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
   b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
   c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against sidewalls, curbs, chimneys, and other roof projections.
4. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap

sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
b. Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
c. Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
d. Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
e. Hips: Extend 18 inches (455 mm) on each side.
f. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
g. Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
h. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
i. Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.

5. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
   a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).

B. Metal Flashing Installation
1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Install metal flashings according to recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope slate shingles and up the vertical surface.
3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying slate shingle. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against the roof-penetrating element, extending concealed flange beneath upslope slate shingles and beyond each side.
5. Hip Flashings: Install centrally over hip with lower edge of flashing concealed by butt of overlying slate shingle. Fasten to roof deck.
6. Open **OR** Closed, **as directed**,-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
   a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
   b. Adhere 9-inch- (230-mm-) wide strips of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
7. Rake Drip Edges: Install over underlayment and fasten to roof deck.
8. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
9. Pipe Flashings: Form flashing around pipe penetrations and slate shingles. Fasten and seal to slate shingles.

C. Slate-Shingle Installation
1. General: Beginning at eaves, install slate shingles according to manufacturer's written instructions and to details and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
   a. Install wood nailer strip cant at eave edges.

b. Install shingle starter course chamfered face down.

2. Install first and succeeding shingle courses with chamfered face up. Install full-width first course at rake edge.
   a. Offset joints of uniform-width slate shingles by half the shingle width in succeeding courses.
   b. Offset joints of random-width slate shingles a minimum of 3 inches (75 mm) in succeeding courses.
3. Maintain a 3-inch- (75-mm-) **OR** 4-inch- (100-mm-), **as directed**, minimum head lap between succeeding shingle courses.
4. Maintain uniform exposure of shingle courses between eaves and ridge **OR** midway between eaves and ridge and increase head lap of succeeding shingle courses to ensure uniform exposure on remaining shingle courses, **as directed**.
5. Extend shingle starter course and first course 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, over fasciae at eaves.
6. Extend shingle starter course and succeeding courses 1 inch (25 mm) over fasciae at rakes.
7. Cut and fit slate neatly around roof vents, pipes, ventilators, and other projections through roof.
8. Hang slate with two **OR** four, **as directed**, slating nails for each shingle with nail heads lightly touching slate. Do not drive nails home drawing slates downward or leave nail head protruding enough to interfere with overlapping shingle above.
   a. For vented ridge, terminate slate shingles leaving uniform air space on each side of ridge apex.
9. Ridges: Install ridge slate in saddle **OR** strip saddle **OR** combing, **as directed**, configuration.
   a. Install and anchor wood nailer strips of thicknesses to match abutting courses of slate shingles, terminating nailer strip 3 to 4 inches (75 to 100 mm) from the eave. Cover with felt underlayment strip, extending to underlying slate but concealed by ridge slate.
   b. Lay ridge slate in bed of asphalt roofing cement **OR** butyl sealant, **as directed**.
   c. Anchor ridge slate to supporting wood nailer strip with two **OR** four, **as directed**, nails for each slate shingle without nails penetrating underlying slate.
   d. Extend combing slate over leeward ridge slate by 1/8 to 1/4 inch (3 to 6 mm). Seal ridge joint with elastomeric sealant.
   e. Cover heads of exposed nails at final ridge shingle with asphalt roofing cement **OR** butyl sealant, **as directed**.
10. Hips: Install and anchor slate hips in saddle **OR** mitered **OR** fantail, **as diorected**, configuration.
    a. Install and anchor wood nailer strips of thickness to match abutting courses of slate shingles. Cover nailer strip with felt underlayment strip, extending on to underlying slate but concealed by hip slate. Anchor hip slate to nailer strip with two nails located in upper third of hip-slate length.
    b. Notch starter shingle and first shingle course at hip to fit around nailer strips so no wood is exposed at ridge eave.
    c. Lay hip slate in bed of asphalt roofing cement **OR** butyl sealant, **as directed**.
    d. Seal hip centerline joint with elastomeric sealant.
11. Open Valleys: Cut slate shingles to form straight lines at open valleys, trimming upper concealed corners of shingles. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
    a. Do not nail shingles to valley metal flashings.
12. Closed Valleys: Cut slate shingles to form straight lines at closed valleys, trimming upper concealed corners of shingles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/4 to 1 inch (19 to 25 mm), **as directed**.
    a. Do not nail shingles to valley metal flashings.

D. Snow-Guard Installation
   1. Snow-Guard Pads: Install rows of snow-guard pads at locations indicated according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter. Space snow guards apart in each row, offsetting by half this dimension between succeeding rows.

2. Snow-Guard Rails: Install rows of snow-guard rails at locations indicated according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter.

E. Accessories Installation
   1. Ridge Caps **OR** Vents, **as directed**: Install units according to manufacturer's written instructions.
      a. Install slate shingles into retention channels, butting adjacent shingles.

F. Adjusting And Cleaning
   1. Remove and replace damaged or broken slate shingles.
   2. Remove excess slate and debris from Project site.

END OF SECTION 07 31 26 00

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SECTION 07 31 29 13 - WOOD SHINGLES AND SHAKES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for wood shingles and shakes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Wood roof shingles and shakes.
   b. Wood wall shingles and shakes.
   c. Wood-shingle-clad panels.
   d. Underlayment.

C. Definitions
1. CSSB: Cedar Shake & Shingle Bureau.
2. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
   a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood shingles and shakes comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.
3. Samples: For each type of wood shingle, shake, ridge and hip unit, and ridge vent indicated.
4. Research/Evaluation Reports: For wood shingles and shakes, from the ICC, **as directed**.
5. Maintenance Data: For wood shingles and shakes to include in maintenance manuals.
6. Warranties: Sample of special warranties.

E. Quality Assurance
1. Grading Agency Qualifications: An independent testing and inspecting agency recognized by authorities having jurisdiction as qualified to label wood shingles and shakes for compliance with referenced grading rules.
2. Forest Certification: Provide shingles and shakes produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
3. Fire-Resistance Characteristics: Where indicated, provide wood shingles and shakes and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
   a. Exterior Fire-Test Exposure: Class B **OR** Class C, **as directed**; UL 790 or ASTM E 108 with ASTM D 2898, for application and roof slopes indicated.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
   a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty
1. Special Warranty: CSSB's standard form in which CSSB agrees to repair or replace wood shingles and shakes that fail in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
   a. Materials-Only Warranty Period: 20 **OR** 25, **as directed**, years for shingles and shakes, and 20 years for manufactured ridge and hip units, from date of Final Completion.

1.2 PRODUCTS

A. Roof Shingles
1. Cedar Roof Shingles: Smooth-sawn western red cedar shingles.
   a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
   b. Grade: No. 1, with starter courses of No. 1 **OR** No. 2 **OR** No. 3, **as directed**.
   c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
2. Ridge and Hip, **as directed**, Units: Manufactured **OR** Site-fabricated, **as directed**, units of same thickness as roof shingle, 7 inches (180 mm) wide; beveled, alternately overlapped, and nailed.
   a. Grade: No. 1.
   b. Length: 16 inches (405 mm) **OR** 18 inches (455 mm), **as directed**.
3. Fancy-Butt Roof Shingles: Clear heartwood red cedar, No. 1 grade, with butt shape indicated.
   a. Butt Shape: Diagonal **OR** Half Cove **OR** Diamond **OR** Round **OR** Hexagonal **OR** Octagonal **OR** Arrow **OR** Square **OR** Fish Scale, **as directed**.
   b. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
   c. Size: 16 inches (405 mm) long; 5 inches (127 mm) wide **OR** 18 inches (455 mm) long; 5 inches (127 mm) wide, **as directed**, by manufacturer's standard thickness.

B. Roof Shakes
1. Cedar Roof Shakes: Handsplit and resawn western red cedar shakes; split face and sawn back.
   a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
   b. Grade: Premium, **OR** No. 1, **as directed**, with starter courses of Premium **OR** No. 1, **as directed**.
   c. Length: 18 inches (455 mm), **OR** 24 inches (610 mm), **as directed**, with 15-inch- (380-mm-) long starter course.
   d. Thickness: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.
2. Cedar Roof Shakes: Tapersawn western red cedar shakes; sawn both sides.
   a. Grading Standard: CSSB's "Grading Rules for Certi-Sawn Tapersawn Cedar Shakes."
   b. Grade: Premium, **OR** No. 1, **as directed**, with starter courses of Premium **OR** No. 1 **OR** No. 2, **as directed**.
   c. Length: 18 inches (455 mm), **OR** 24 inches (610 mm), **as directed**, with 15-inch- (380-mm-) long starter course.
   d. Thickness: 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.
3. Cedar Roof Shakes: Tapersplit western red cedar shakes; handsplit.
   a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
   b. Grade: Premium, with premium starter courses.
   c. Length: 24 inches (610 mm), with 15-inch- (380-mm-) long starter course.
   d. Thickness: 1/2 inch (13 mm) at butt.
4. Cedar Roof Shakes: Straightsplit western red cedar shakes; machine split or handsplit.
   a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
   b. Grade: Premium, with premium starter courses.

c. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, with 15-inch- (380-mm-) long starter course.
d. Thickness: 3/8 to 1/2 inch (10 to 13 mm) at butt.

5. Ridge and Hip, **as directed**, Units: Manufactured **OR** Site-fabricated, **as directed**, units of same grade as shake, 9 inches (230 mm) wide; beveled, alternately overlapped, and nailed.
a. Type: Handsplit and resawn **OR** Tapersawn, **as directed**.
b. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
c. Thickness: 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.

C. Wall Shingles
1. Cedar Wall Shingles: Smooth-sawn western red cedar shingles.
a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
b. Grade: No. 1 **OR** No. 2 **OR** No. 3, **as directed**.
c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
d. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
e. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.

2. Cedar Wall Shingles: Rebutted and rejointed, smooth-sawn **OR** sanded, **as directed**, western red cedar shingles.
a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
b. Grade: No. 1 **OR** No. 2, **as directed**.
c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
d. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
e. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.

3. Cedar Wall Shingles: Rebutted and rejoined, machine-grooved, smooth-sawn western red cedar.
a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
b. Grade: No. 1.
c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
d. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
e. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.

4. Fancy-Butt Wall Shingles: Clear heartwood red cedar, No. 1 grade, with butt shape indicated.
a. Butt Shape: Diagonal **OR** Half Cove **OR** Diamond **OR** Round **OR** Hexagonal **OR** Octagonal **OR** Arrow **OR** Square **OR** Fish Scale, **as directed**.
b. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
c. Size: 16 inches (405 mm) long; 5 inches (127 mm) wide **OR** 18 inches (455 mm) long; 5 inches (127 mm) wide, **as directed**, by manufacturer's standard thickness.

5. Cedar Wall Shingle Finish: Unfinished **OR** Semitransparent penetrating stain, oil based, factory applied **OR** Semisolid penetrating stain, oil based, factory applied **OR** Oil-based primer, stain blocking, factory applied, **as directed**.

D. Wall Shakes
1. Cedar Wall Shakes: Handsplit and resawn western red cedar shakes; split face and sawn back.
a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
b. Outer Course Grade: Premium **OR** No. 1, **as directed**.
c. Starter Course **OR** Undercourse, **as directed**, Grade: No. 1 **OR** Standard, **as directed**.
d. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
e. Thickness: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.

2. Cedar Wall Shakes: Tapersawn western red cedar shakes; sawn both sides.

a. Grading Standard: CSSB's "Grading Rules for Certi-Sawn Tapersawn Cedar Shakes."
b. Outer Course Grade: Premium **OR** No. 1 **OR** No. 2, **as directed**.
c. Starter Course **OR** Undercourse, **as directed**, Grade: No. 1 **OR** No. 2 **OR** No. 3, **as directed**.
d. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
e. Thickness: 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.

3. Cedar Wall Shakes: Tapersplit western red cedar shakes; handsplit.
   a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
   b. Grade: Premium.
   c. Length: 24 inches (610 mm).
   d. Thickness: 1/2 inch (13 mm) at butt.
   e. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
   f. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
4. Cedar Wall Shakes: Straightsplit western red cedar shakes; machine split or handsplit.
   a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
   b. Grade: Premium.
   c. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
   d. Thickness: 3/8 to 1/2 inch (10 to 13 mm) at butt.
   e. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
   f. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
5. Cedar Wall Shake Finish: Unfinished **OR** Semitransparent penetrating stain, oil based, factory applied **OR** Semisolid penetrating stain, oil based, factory applied **OR** Oil-based primer, stain blocking, factory applied, **as directed**.

E. Wood-Shingle-Clad Panels
1. Cedar Shingle Panels: Clear, vertical-grain, western red cedar shingles bonded with exterior-type adhesives to 5/16-inch- (8-mm-) thick, 96-inch- (2400-mm-) long, DOC PS 1 Exterior C-D plywood panels.
   a. Number of Courses per Panel: One **OR** Two **OR** Three **OR** Four, **as directed**.
   b. Butt Style: Straight line **OR** Staggered, **as directed**.
   c. Fancy-Butt Style: Diagonal **OR** Half Cove **OR** Diamond **OR** Round **OR** Hexagonal **OR** Octagonal **OR** Arrow **OR** Square **OR** Fish Scale, **as directed**.
   d. Exposure: 4-1/2 inches (115 mm) **OR** 5 inches (127 mm) **OR** 7 inches (180 mm), **as directed**, per course.
2. Prefabricated Corners: Flush **OR** Flush, with staggered ends **OR** Add-on, **as directed**, type.

F. Wood Treatments
1. Fire-Retardant Treatment: Exterior-type pressure treatment complying with AWPA C1, **as directed**.
2. Pressure-Preservative Treatment: AWPA C34, chromated copper arsenate (CCA) pressure treatment; a minimum of 0.40 lb/cu. ft. (6.4 kg/cu. m).
3. Identification: Attach a label to each bundle of wood shingles or shakes; identify manufacturer, references to model-code approval, type of product, grade, dimensions, and approved grading agency.
   a. Include chemical treatment, method of application, purpose of treatment, and warranties available.

G. Underlayment Materials
1. Felt Underlayment: ASTM D 226 **OR** ASTM D 4869, **as directed**, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt.
2. Felt Interlayment: ASTM D 226 **OR** ASTM D 4869, **as directed**, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt.

3. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
4. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, a minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.

H. Ridge Vents
1. Rigid Ridge Vent: Manufacturer's standard rigid section, high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and external deflector baffles, **as directed**; for use under ridge shingles and shakes.
2. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter bonded to a nonwoven, nonwicking, geotextile fabric cover, **as directed**; for use under roof shingles and shakes.

I. Accessories
1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Drainage Mat: Manufacturer's standard, compression-resisting, three-dimensional, nonwoven, entangled filament, nylon mat designed to permit air movement and drain incidental moisture by gravity.
3. Roofing Nails: ASTM F 1667, aluminum **OR** stainless-steel **OR** hot-dip galvanized-steel, **as directed**, wire nails, sharp pointed, and of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.
   a. Use box **OR** shingle, **as directed**,-type nails for wood shingles.
   b. Use box-type nails for wood shakes.
   c. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
4. Roofing Staples: Type 304 or Type 316, stainless-steel staples, 0.05-inch (1.3-mm) thick, with a minimum of 7/16-inch (11-mm) crown width, of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.
5. Felt Underlayment and Interlayment, **as directed**, Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire nails; with 1-inch- (25-mm-) minimum diameter, low-profile capped heads or disc caps.
6. Wood Lath Strip: Western red cedar, clear heartwood, a minimum of 1-1/2 inches (38 mm) wide.

J. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim"
   a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.
2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
   a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope wood roofing and 6 inches (152 mm) up the vertical surface.
   b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
   c. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope wood roofing and 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.

d. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile at center of valley and equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
e. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.

3. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation
1. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
   a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
   a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
   b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
   c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against sidewalls, curbs, chimneys, and other roof projections.
4. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
   a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
   b. Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
   c. Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
   d. Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
   e. Hips: Extend 18 inches (455 mm) on each side.
   f. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
   g. Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).

h. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
i. Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.

5. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
   a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).

B. Metal Flashing Installation
1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Install metal flashings according to recommendations for wood roofing in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope wood roofing and up the vertical surface.
3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying shingle or shake. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against the roof-penetrating element, extending concealed flange beneath upslope wood roofing and beyond each side.
5. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
   a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
   b. Adhere 9-inch- (230-mm-) wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
6. Rake Drip Edges: Install over underlayment and fasten to roof deck.
7. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
8. Pipe Flashings: Form flashing around pipe penetrations and wood roofing. Fasten and seal to wood roofing.

C. Roof-Shingle Installation
1. General: Install wood-shingle roofing according to manufacturer's written instructions and to recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a continuous layer, and fasten to roof deck.
3. Install single **OR** double, **as directed**,-layer wood-shingle starter course along lowest roof edge. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over fascia and 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
   a. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
4. Install first course of wood shingles directly over starter course and in continuous straight-line courses across roof deck. Install second and succeeding courses of wood shingles in continuous straight-line courses across roof deck. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
   a. Offset joints between shingles in succeeding courses a minimum of 1-1/2 inches (38 mm). Limit alignment of vertical joints in every third course to not exceed 10 percent of joints.
   b. Space shingles a minimum of 1/4 inch (6 mm) and a maximum of 3/8 inch (10 mm) apart.
   c. Fasten each shingle with two nails **OR** staples, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shingle and 1-1/2 to 2 inches (38 to 50 mm) above butt line of succeeding course. Drive fasteners flush with top surface of shingles without crushing wood.

d. Maintain weather exposure of 5 inches (127 mm) for 16-inch- (405-mm-) **OR** 5-1/2 inches (140 mm) for 18-inch- (455-mm-) **OR** 7-1/2 inches (190 mm) for 24-inch- (610-mm-), **as directed**, long shingles.

5. Open Valleys: Cut and fit wood shingles at open valleys, trimming upper concealed corners of shingles. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
6. Fancy-Butt Shingles: Install one **OR** two **OR** three, **as directed**, courses of fancy-butt shingles in continuous straight-line courses across roof deck. Center each shingle in succeeding courses between the two shingles below it with 1/8-inch (3-mm) space between shingles.
   a. Maintain weather exposure of 5 inches (127 mm).
7. Ridge Vents: Install continuous ridge vents over wood shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate roof sheathing.
8. Ridge and Hip, **as directed**, Units: Install units over wood shingles trimmed at apex. Maintain same exposure dimension of units as roof-shingle exposure. Lap units at ridges to shed water away from direction of prevailing winds. Alternate overlaps of units and fasten with concealed roofing nails of sufficient length to penetrate sheathing.
   a. Install concealed strip of felt underlayment over apex shingles and fasten with felt underlayment nails.
   b. Fasten ridge units to cover ridge vent without obstructing airflow.

D. Roof-Shake Installation
1. General: Install wood-shake roofing according to manufacturer's written instructions and to recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a continuous layer, and fasten to roof deck.
3. Install single **OR** double, **as directed**,-layer wood-shake starter course along lowest roof edge. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over fascia and 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
   a. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
4. Install first course of wood shakes directly over starter course and in continuous straight-line courses across roof deck. Install second and succeeding courses of wood shakes in continuous straight-line courses across roof deck. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
   a. Install 18-inch- (455-mm-) wide strip of felt interlayment over top portion of first and each succeeding course. Set bottom edge of felt interlayment at a distance of twice the weather-exposure dimension above the shake butt. Stagger fasten to roof deck with felt underlayment nails.
   b. Offset joints between shakes in succeeding courses a minimum of 1-1/2 inches (38 mm).
   c. Space shakes a minimum of 3/8 inch (10 mm) and a maximum of 5/8 inch (16 mm) apart.
   d. Fasten each shake with two nails **OR** staples, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shake and 1-1/2 to 2 inches (38 to 50 mm) above butt line of succeeding course. Drive fasteners flush with top surface of shakes without crushing wood.
   e. Maintain weather exposure of 5-1/2 inches (140 mm) for 18-inch- (455-mm-) **OR** 7-1/2 inches (190 mm) for 18-inch- (455-mm-) **OR** 7-1/2 inches (190 mm) for 24-inch- (610-mm-) **OR** 10 inches (255 mm) for 24-inch- (610-mm-), **as directed**, long shakes.
5. Open Valleys: Cut and fit wood shakes at open valleys, trimming upper concealed corners of shakes. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
6. Ridge Vents: Install continuous ridge vents over wood shakes according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
7. Ridge and Hip, **as directed**, Units: Install units over wood shakes trimmed at apex. Maintain same exposure dimension of units as roof-shake exposure. Lap units at ridges to shed water away from direction of prevailing winds. Alternate overlaps of units and fasten with concealed roofing nails of sufficient length to penetrate sheathing.

a. Install concealed strip of felt underlayment over apex shakes and fasten with felt underlayment nails.
b. Fasten ridge units to cover ridge vent without obstructing airflow.

E. Wall-Shingle Installation, Single Coursed
1. Install wood wall shingles according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shingles, butting edges and ends to form a continuous layer; fasten to wall sheathing.
3. Install wood shingles, beginning at base of wall, with a double-layer starter course in a continuous straight line. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
   a. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
4. Install first course of wood shingles over starter course. Install second and succeeding courses of wood shingles. Offset joints between shingles in succeeding courses a minimum of 1-1/2 inches (38 mm).
   a. Install shingles in continuous straight-line courses.
      OR
      Install shingle courses with butt lines staggered 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, from true butt line.
   b. Install primed shingles with sides abutting **OR** Space shingles 1/8 to 1/4 inch (3 to 6 mm) apart, **as directed**.
   c. Fasten each shingle with two concealed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shingle and 1 inch (25 mm) above butt line of succeeding course. For shingles wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shingle. Drive fasteners flush with top surface of shingles without crushing wood.
   d. Maintain weather exposure of 7-1/2 inches (190 mm) for 16-inch- (405-mm-) **OR** 8-1/2 inches (215 mm) for 18-inch- (455-mm-) **OR** 11-1/2 inches (290 mm) for 24-inch- (610-mm-), **as directed**, long shingles.
   e. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
   f. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.
5. Fancy-Butt Shingles: Install fancy-butt shingles where indicated, in continuous straight-line courses along wall. Center each shingle in succeeding courses between the two shingles below it with primed shingles abutting **OR** 1/8-inch (3-mm) space between shingles, **as directed**.
   a. Maintain weather exposure of 7-1/2 inches (190 mm).
   b. Interior Corner Treatment: Butted against wood stop.
   c. Exterior Corner Treatment: Butted against corner boards **OR** Mitered, **as directed**.

F. Wall-Shingle Installation, Double Coursed
1. Install wood wall shingles in continuous straight-line courses according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shingles, butting edges and ends to form a continuous layer; fasten to wall sheathing.
3. Install double-layer undercourse of wood shingles beginning at base of wall. Offset joints of each undercourse layer a minimum of 1-1/2 inches (38 mm). Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
   a. Extend undercourse 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
   b. Fasten two layers of lath wood strips at base of undercourse to match thickness of double-layer undercourse. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
4. Install succeeding undercourse layers against wood lath strip, **as directed**. Offset joints between undercourse and outer course a minimum of 1-1/2 inches (38 mm).

a. Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.

5. Install single wood lath strip on first and succeeding outer courses to match thickness of undercourse and at height that results in specified outer course weather exposure.
6. Install first and succeeding outer courses of wood shingles directly over undercourses, projecting 1/2 inch (13 mm) below undercourse **OR** lath strips, **as directed**. Offset joints between shingles and undercourse a minimum of 1-1/2 inches (38 mm). Offset joints between shingles in succeeding outer courses a minimum of 1-1/2 inches (38 mm).
   a. Install primed outer shingles with sides abutting **OR** Space outer shingles 1/8 to 1/4 inch (3 to 6 mm) apart, **as directed**.
   b. Fasten each shingle with two exposed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shingle and 2 inches (50 mm) above butt line of succeeding course. For outer course shingles wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shingle. Drive fasteners flush with top surface of shingles without crushing wood.
   c. Maintain weather exposure of 12 inches (305 mm) for 16-inch- (405-mm-) **OR** 14 inches (355 mm) for 18-inch- (455-mm-) **OR** 16 inches (405 mm) for 24-inch- (610-mm-), **as directed**, long shingles.
   d. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
   e. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.

G. Wall-Shake Installation, Single Coursed
1. Install wood wall shakes according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shakes, butting edges and ends to form a continuous layer; fasten to wall sheathing.
3. Install wood shakes, beginning at base of wall, with a double-layer starter course in a continuous straight line. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
   a. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
4. Install first course of wood shakes over starter course. Install second and succeeding course of wood shakes. Offset joints between shakes in succeeding courses a minimum of 1-1/2 inches (38 mm).
   a. Install shakes in continuous straight-line courses.
      OR
      Install shake courses with butt lines staggered 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, from true butt line.
   b. Install primed shakes with sides abutting **OR** Space shingles 1/8 to 1/4 inch (3 to 6 mm) apart, **as directed**.
   c. Fasten each shake with two concealed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shake and 1 inch (25 mm) above butt line of succeeding course. For shakes wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shake. Drive fasteners flush with top surface of shakes without crushing wood.
   d. Maintain weather exposure of 7-1/2 inches (190 mm) for 16-inch- (405-mm-) **OR** 8-1/2 inches (215 mm) for 18-inch- (455-mm-) **OR** 11-1/2 inches (290 mm) for 24-inch- (610-mm-), **as directed**, long shakes.
   e. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
   f. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.

H. Wall-Shake Installation, Double Coursed

1. Install wood wall shakes in continuous straight-line courses according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shakes, butting edges and ends to form a continuous layer; fasten to wall sheathing.
3. Install double-layer undercourse of wood shingles beginning at base of wall. Offset joints of each undercourse layer a minimum of 1-1/2 inches (38 mm). Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
   a. Extend undercourse 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
   b. Fasten two layers of lath wood strips at base of undercourse to match thickness of double-layer undercourse. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
4. Install succeeding undercourse layers against wood lath strip, **as directed**. Offset joints between undercourse and outer course a minimum of 1-1/2 inches (38 mm).
   a. Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
5. Install single wood lath strip on first and succeeding outer courses to match thickness of undercourse and at height that results in specified outer course weather exposure.
6. Install first and succeeding outer courses of wood shakes directly over undercourses, projecting 1/2 inch (13 mm) below undercourse **OR** lath strips, **as directed**. Offset joints between shakes and undercourse shingles a minimum of 1-1/2 inches (38 mm). Offset joints between shakes in succeeding outer courses a minimum of 1-1/2 inches (38 mm).
   a. Install primed outer shakes with sides abutting **OR** Space outer shakes 1/4 to 3/8 inch (6 to 10 mm) apart, **as directed**.
   b. Fasten each shake with two exposed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shake and 2 inches (50 mm) above butt line of succeeding course. For shakes wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shake. Drive fasteners flush with top surface of shake without crushing wood.
   c. Maintain weather exposure of 12 inches (305 mm) for 16-inch- (405-mm-) **OR** 14 inches (355 mm) for 18-inch- (455-mm-) **OR** 18 inches (455 mm) for 24-inch- (610-mm-), **as directed**, long shakes.
   d. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
   e. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.

I. Wood-Shingle-Clad Panel Installation
1. Install wood-shingle-clad panels and corner units, **as directed**, according to manufacturer's written instructions.
2. Install panels level, plumb, true, and aligned with adjacent materials.
3. Install panels working from the lowest level to the top of the wall area.

END OF SECTION 07 31 29 13

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Task	Specification	Specification Description
07 31 29 16	07 31 29 13	Wood Shingles And Shakes
07 31 29 19	01 22 16 00	No Specification Required

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SECTION 07 31 33 00 - COMPOSITE RUBBER SHINGLES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for composite rubber shingles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
2. Furnish and install this Majestic Slate Tile Roof System in strict accordance with specifications and drawings approved by EcoStar.
3. Metal flashing work is not covered in this specification since EcoStar does **NOT** warrant metal flashing. EcoStar advises that metal flashing and securement of metal should be to industry standards (SMACNA) to prevent the metal from pulling free or buckling. EcoStar also suggests that all flashing metal be copper, stainless steel or an equally long-term material.
4. EcoStar Attic Guard Ridge Ventilation product must be used on those projects that will be using a ridge ventilation system. If a ridge ventilation system is not to be used on the project, another form of ventilation may be used, but will not be covered by any EcoStar warranties. EcoStar advises that a ridge style venting system be utilized to insure the best possible air movement and to provide the best aesthetic appearance to the roofing system.

B. Definitions
1. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

C. Submittals
1. Submit an “EcoStar Gold Star Project Survey” to EcoStar Technical Department for approval **PRIOR** to the job start to enable the Technical Department to approve and assign a job number to the project.
2. The “EcoStar Gold Star Project Survey Form” must be filled out completely and accurately to include any prior deviations approved from this specification, including a roof drawing showing all dimensions, all penetrations, and roof slope.
3. When an EcoStar Gold Star Warranty is desired, EcoStar must be contacted **PRIOR** to project bid and installation. Information may be required for wind design and slope requirements.
4. Product Data: For each type of product indicated.
5. Samples: For the following products, of sizes indicated.
   a. Composite Rubber Shingle: Full size, of each color, size, texture, and shape.
   b. Ridge Vent System: 12 inches (300 mm) long.
   c. Fasteners: Three fasteners of each type, length, and finish.
   d. Underlayment: 12 inches (300 mm) square.

D. Quality Assurance
1. To qualify for an EcoStar Gold Star Warranty, an authorized EcoStar Gold Star Applicator must install system.
2. There shall be no deviation made from this specification without written approval from EcoStar prior to the start of the roofing project.
3. For an EcoStar Gold Star Warranty, upon completion of the installation, an inspection must be conducted by a Technical Representative of EcoStar to ascertain that the roofing system has been installed according to EcoStar’s most current published specifications and details. This inspection is not intended to be a Final Inspection for the benefit of the Owner, but for the benefit of EcoStar to determine whether a warranty shall be issued.
4. Class C Testing Requirements:
   a. Fire Resistance - UL 790 Test Standard
   b. Class 4 Impact Resistance - UL 2218 Test Standard

c. 110 mph wind load - PA100-95 Test Standard
d. Wind uplift - 105 lbs / sq ft - UL 1897 Test Standard

5. Class A Testing Requirements:
   a. Fire Resistance - UL 790 Test Standard
   b. Class 4 Impact Resistance - UL 2218 Test Standard

E. Product Delivery, Storage And Handling
1. Deliver materials in original unopened packages.
2. Packages shall be labeled with manufacturer's name, brand name, installation instructions and identification of various items.
3. All tile materials must be stored between 45^{O} F. and 80^{O} F. If exposed to lower temperatures, restore to 45^{O} F minimum temperature before using.
4. Store all materials in a dry protected area. Damaged materials must **NOT** be used. Installed materials found to be damaged shall be replaced at Gold Star Authorized Applicator's expense.

F. Job Conditions (Cautions And Warnings)
1. Contact EcoStar Technical Department for procedures when installing a Majestic Slate Tile Roof System during temperatures less than 45^{O} F.
2. Do not install the Majestic Slate Tile Roof System directly over existing asphalt shingles or existing tile roof systems. All existing roof materials **MUST** be removed prior to installation of the Majestic Slate Tile System.
3. Roofing surface must be free of ice, water, or snow prior to and during the roofing project.

G. Warranty
1. Roofing materials manufacturer will provide the warranty for those materials supplied by the manufacturer when the project is completed by a manufacturer's authorized applicator and all required materials have been utilized within the roof system.
2. Only when a manufacturer's technical representative has inspected and approved the completed installation will a warranty be issued.
3. The warranty is available for all types of buildings and structures.
4. The warranty period is expressed on the warranty certificate, which reflects the inclusive dates of coverage.
5. The warranty does NOT cover the aesthetic appearance of the Majestic Slate - Tiles. Care should be taken by the authorized applicator to ensure that proper blending of the tiles occurs. When improper blending occurs the aesthetic appearance of the roof can be effected negatively. Blending should occur from a minimum of seven bundles from each pallet. It is highly suggested that all material be on site to blend from.
6. Only products supplied by EcoStar, a Division of Carlisle SynTec Incorporated, are included in the warranty unless otherwise specified and approved in writing by EcoStar, a Division of Carlisle SynTec Incorporated.

1.2 PRODUCTS

A. Manufacturer
1. All Components of the Majestic Slate - Tile Roof System are to be products manufactured or supplied by EcoStar, a Division of Carlisle SynTec Incorporated, or approved equivalent.

B. Class C Tile Roofing System
1. Slate Tiles/Shingles: Tiles made of Starloy™, 100% recycled rubber and plastic compound, 12" wide by 18" long with a nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures:
   7" 241 - 258 lbs per square
   6-1/2" 259 - 278 lbs per square
   6" 280 - 300 lbs per square

a. Color: As selected from manufacturer's standard colors, unless directed otherwise.

2. Underlayment
   a. AquaGuard - a roofing underlayment recognized for use as an alternative to Type 30 roofing underlayment, consisting of spunbonded polypropylene coated with a layer of U.V. stabilized polypropylene on both sides, meeting requirements of ASTM D2626, referred to as 30 lb and without perforations.
   b. Glacier Guard ice and water underlayment - Granular Surface (55 mil), Smooth Surface (40 mil), or Smooth Surface High Temperature (40 mil), a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface and Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).

C. Class A Tile Roofing System
1. Slate Tiles/Shingles: Tiles made of Starloy™, 100% recycled rubber and plastic compound, 12" wide by 18" long with a nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures:
   7" 258 - 276 lbs per square
   6-1/2" 278 - 294 lbs per square
   6" 300 - 321 lbs per square
   a. Color: As selected from manufacturer's standard colors, unless directed otherwise.
2. Underlayment
   a. VersaShield - One layer of Elk VersaShield meeting or exceeding the requirements of ASTM D226.
   b. Glacier Guard ice & water underlayment - Granular Surface (55 mil), Smooth Surface (40 mil), or Smooth Surface High Temperature (40 mil), a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface and Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).

D. Fasteners
1. AquaGuard/VersaShield
   a. Roofing nails with one inch (1") diameter round or square head, plastic or metal, and 3/4" long shank. Metal parts of fastener are to be corrosion resistant.
2. Tile Fasteners
   a. EcoStar Roofing Nail with a 3/8" diameter head and a minimum of 1-1/2" long shank made from stainless steel. Nails can be supplied either as a hand drive style or in coils for use in pneumatic tools.

1.3 EXECUTION

A. Substrate Criteria
1. The Building owner or the Owner's Representative is responsible for providing and determining that the substrate is suitable to receive the Majestic Slate Tile Roof System and the authorized EcoStar Gold Star Applicator should not proceed until all defects have been corrected.
2. The Majestic Slate Roof System may only be applied over:
   a. Minimum ½" plywood or OSB decking
   b. Minimum 1" tongue and groove wood decking
   c. Approved metal deck systems - for specifics contact roofing materials manufacturer.
3. Minimum slope of substrate for installation of Majestic Slate Roof System shall be a minimum of 3/12 for 6" exposure installation and a minimum of 6/12 for 7" exposure installation. Contact the EcoStar Technical Department for approval of applications on lower slopes or exceptions to this requirement.

B. Substrate Preparation

1. The Building Owner or the Owner's Representative is responsible for ensuring that all wet or damaged substrate has been removed in a re-roofing application.
2. Existing roof material **MUST** be removed and a clean substrate free of foreign material be provided prior to the installation of the Majestic Slate Tile Roof System. Majestic Slate Tiles may **NOT** be installed directly over any existing roof material or system.

C. Installation
1. Flashing and Sheet Metal:
   a. Install sheet metal and flashing metal in all valleys and where required on projections furnish in accordance with Division 07 Section "Sheet Metal Flashing And Trim".
   b. Where required, install metal starter strip at all eaves and roof edges. Furnish metal in accordance with Division 07 Section "Sheet Metal Flashing And Trim".
   c. The roofing materials manufacturer suggests that all metal work be made from copper, stainless steel or an equally long-term material.
2. Underlayment:
   a. AquaGuard:
      1) Apply 41.5" wide sheet over complete deck, lapping the area covered with Glacier Guard ice and water underlayment. Lap end joints 6" and side joints 4" and double through valleys.
      2) Do not leave exposed to weather more than 90 days after beginning of installation without written approval of the Owner.
      3) Do not leave any fastener heads exposed. Nail only in areas to be covered by lapping of underlayment.
   b. VersaShield:
      1) Apply 42" wide sheet over complete deck, covering the entire roof deck **INCLUDING** those areas with Glacier Guard Ice & Water underlayment. Lap end joints 4" and side joints 6".
      2) Lap the VersaShield 6" from both sides over all hips, valleys, and ridges.
      3) Where the roof meets a vertical surface, carry the VersaShield 3" to 4" up the surface.
      4) Do not leave exposed to weather more than **60** days after beginning of installation without written approval of the Owner.
      5) Do not leave any fastener heads exposed. Nail only in areas to be covered by lapping of underlayment.
   c. Glacier Guard Ice and water underlayment:
      1) Lap end joints 6" and side joints 3.5"
      2) Apply continuous 36" wide sheet in valley centered over valley.
      3) Apply rows of 36" wide sheets along all eaves and rakes. Lap end joints 6" and side joints 3.5".
      4) Apply rows of 36" wide sheets along and around all dormers and roof projections. Lap end joints 6" and side joints 3.5".
      5) When applicable install as far as it can be installed on any head walls or vertical walls a minimum of 12".
      6) Do not leave Glacier Guard Granular Surface exposed to weather more than 14 days after beginning of installation. Do not leave Glacier Guard Smooth Surface exposed to weather more than 30 days after beginning of installation. Do not leave Glacier Guard Smooth Surface High Temp exposed to the weather more than 60 days after the beginning of installation.
3. Tile/Shingle Installation
   a. After installing underlayment and before installing the tiles, clean the surface of debris and dirt.
   b. Beginning at the eave, install a layer of tiles gapped a minimum of 3/8" between tiles and any projections, with two roofing fasteners per tile (in location shown on tiles). This layer of tiles will become the starter row. Install another layer of tiles in the same manner as the first with the exception of the second layer having a 1/2 tile offset to the first layer.

c. Continue installing tiles per the chosen exposure.
d. Care must be taken to place tiles so color variations are evenly distributed over the entire roof area. Tiles between bundles and pallets **MUST** be shuffled to insure even distribution of color variations. "Patchy" or "Blotching" in appearance is not acceptable and the applicator will be required to correct. It is recommended that work not begin until all roofing materials have been delivered to the job site.
e. It is the responsibility of the applicator to ensure that all tiles are bent back in a downward curve prior to installation. **Do not install tiles with an upward curve**.
f. Either an open or closed valley design may be used.
    1) With an open valley design leave a minimum of 2" on each side of the center of the valley exposed and uncovered by the roof tiles. A V-Style or W-Style Valley metal may be used.
    2) With a closed valley design cut the tiles in a straight line to fit no closer than 3/8" against tile of adjoining roof slope.
g. Minimum Fastening - No less than 2 approved fasteners per tile, with a minimum length of 1-1/2", shall be used.
h. CAUTION: When using a pneumatic nailer, care shall be taken to ensure that nails are not over driven causing the tiles to curl upward. If tiles have been installed with over-driven nails causing the ends of the tile to curve upward, tiles will never lay flat. Over-driven tiles must be removed and re-nailed properly.
i. Install EcoStar Attic Guard ridge vent system per the manufacturer's application instructions, and then place the Majestic Slate - Universal Hip/Ridge Tile over the ridge vent. A minimum 2.5" stainless steel, hand-driven EcoStar fastener should be used on a ventilated hip/ridge to fasten the hip/ridge tile to the deck. A minimum 2" stainless steel, hand-driven EcoStar fastener should be used on an unventilated hip/ridge to fasten the hip/ridge tile to the deck. Place fasteners in the location marked on the tile. Majestic Slate - Universal Hip/Ridge Tile must be installed with 6" exposure.
j. Tiles may not be installed if the tiles have been stored in temperatures lower than 45^{O} F. If tiles have been stored in temperatures below 45^{O} F., tiles must be brought back to an ambient material temperature of 45^{O} F. As the temperature rises, tiles will expand beyond the designed installation pattern if the product is installed while cold or frozen.
k. Do not install tiles directly adjacent to each other. A minimum gap of 3/8" must be maintained between installed tiles.
l. After the initial row of tiles has been installed, it is recommended that a chalk line be placed parallel to the roof edge and running perpendicular to the first row of tiles. This chalk line will ensure that the tiles stay true and plumb to the roof edge throughout installation.
m. Care must be taken to minimize foot traffic over completed areas of the roof. Tiles will show mud and dirt and cause appearance problems. The removal of dirt and debris is the responsibility of the applicator.
n. Tiles can be slippery when wet, caution should be exhibited with early morning dew and after rain. The tile manufacturer suggests the use of toe boards and OSHA approved harnesses and safety equipment at all time.
o. Upon completion of the roof system installation, inspect and remove all debris from roof, sweep clean and wash with a mild, non-bleaching detergent.

END OF SECTION 07 31 33 00

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Task	Specification	Specification Description
07 31 33 00	01 22 16 00	No Specification Required

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SECTION 07 32 13 00 - CLAY ROOF TILES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for clay roof tiles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Clay roof tiles.
b. Underlayment.
c. Snow guards.

C. Definitions
1. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Test Reports for Credit SS 7.2: For clay roof tiles, documentation indicating compliance with Solar Reflectance Index requirement.
3. Samples: For each type of clay roof tile and accessory tile indicated.
4. Material test reports.
5. Research/evaluation reports.
6. Maintenance data.
7. Warranties: Sample of special warranties.

E. Quality Assurance
1. Fire-Test-Response Characteristics: Provide clay roof tiles and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
a. Exterior Fire-Test Exposure: Class A **OR** Class B **OR** Class C, **as directed**; UL 790 or ASTM E 108, for application and roof slopes indicated.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty
1. Special Warranty: Standard form in which manufacturer agrees to repair or replace clay roof tiles that fail in materials within specified warranty period.
a. Materials-Only Warranty Period: 50 years from date of Final Completion.

1.2 PRODUCTS

A. Clay Roof Tiles
1. Clay Roof Tiles: ASTM C 1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired to vitrification, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.
   a. Durability: Grade 1 **OR** Grade 2 **OR** Grade 3, **as directed**.
   b. High-Profile Shape: Type I, Spanish or "S" **OR** Type I, tapered mission, two piece **OR** Type I, straight mission, two piece **OR** Type I, straight barrel mission, two piece **OR** Type I, Greek, two piece **OR** Type I, Roman, two piece, **as directed**.
   c. Low-Profile Shape: Type II, French interlocking.
   d. Flat Shape: Type III, flat shingle **OR** Type III, flat interlocking, **as directed**.
      1) Provide clay roof tiles of diminishing widths for circular bays or round towers.
   e. Solar Reflectance Index: Provide clay roof tile with Solar Reflectance Index not less than 29 when calculated according to ASTM E 1980, based on testing of identical products by a qualified testing agency.
   f. Finish and Texture: Matte, smooth **OR** Matte, striated **OR** Glazed, smooth, **as directed**.
   g. Color: Terra cotta **OR** Brown **OR** Red **OR** Blended red **OR** Buff, **as directed**.
   h. High **OR** Low, **as directed**,-Profile-Shape Accessory Tiles: Ridge, ridge vent, ridge end, hip and hip starter, header course, L-shaped rake edge, roll rake edge, starter, end band, terminal, eave closure, and top fixture, **as directed**, units, in color matching clay roof tiles.
   i. Flat-Shape Accessory Tiles: Ridge and closed ridge end, hip and hip starter, header course, L-shaped rake edge, starter, end band, and terminal, **as directed**, units, in color matching clay roof tiles.

B. Accessories
1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** silicone, **as directed**,-based joint sealant; Type M **OR** Type S, **as directed**, Grade NS, Class 25, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.
4. Roofing Asphalt: ASTM D 312, Type IV.
5. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
6. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended for application by clay roof tile manufacturer.
   OR
   Mortar: ASTM C 270, Type M, natural color **OR** with ASTM C 979, pigmented mortar matching the color of clay roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar, **as directed**.
7. Eave Closure: Manufacturer's standard EPDM **OR** copper **OR** stainless-steel **OR** galvanized-steel **OR** aluminum, mill finish, **as directed**, eave closure formed to shape of clay roof tile.
8. Wood Nailers, Beveled Cant Strips and Wood Battens: Comply with requirements for pressure-preservative-treated wood in Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.
9. Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) mesh of PVC-coated, glass-fiber thread.

C. Fasteners
1. Roofing Nails: ASTM F 1667, copper, 0.135-inch- (3.4-mm-) **OR** aluminum, 0.1055-inch- (2.7-mm-) **OR** hot-dip galvanized-steel, 0.1055-inch- (2.7-mm-), **as directed**, diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch- (10-mm-) diameter head; of sufficient length to penetrate 3/4 inch (19 mm) into wood battens **OR** solid wood decking **OR** roof-deck sheathing, **as directed**.

a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

2. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
3. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.
4. Wire Ties: Copper **OR** Brass **OR** Stainless steel, **as directed**, 0.083-inch (2.1-mm) minimum diameter.
5. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed 6 inches (152 mm) apart, minimum 0.1-inch- (2.5-mm-) diameter brass wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.1-inch- (2.5-mm-) diameter copper wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.083-inch- (2.1-mm-) diameter stainless-steel wire and 0.037-inch- (0.94-mm-) diameter stainless-steel tie wires **OR** 0.083-inch- (2.1-mm-) diameter galvanized-steel wire and 0.037-inch- (0.94-mm-) diameter galvanized-steel tie wires, **as directed**, with matching-metal folding clip anchors.
6. Single-Line, Wire-Tie System: Interconnecting eave-to-ridge system, minimum 0.1-inch- (2.5-mm-) diameter brass **OR** 0.09-inch- (2.3-mm-) diameter galvanized-steel, **as directed**, wire, preformed to accommodate clay roof tile type and application indicated.
7. Hook Nails: One-piece wind lock and clay roof tile fastener system, minimum 0.1-inch- (2.5-mm-) diameter brass **OR** 0.09-inch- (2.3-mm-) diameter galvanized-steel, **as directed**, wire, for direct deck nailing.
8. Tile Locks: Brass **OR** Copper **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, 0.1-inch- (2.5-mm-) diameter wire device designed to secure butt edges of overlaid clay roof tiles.
9. Storm Clips: Brass **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, strap-type, 0.04-by-1/2-inch (1.0-by-13-mm), L-shaped retainer clips designed to secure side edges of clay roof tiles. Provide with two fastener holes in base flange.

D. Underlayment Materials
1. Felt Underlayment: ASTM D 226, Type II, asphalt-saturated organic felt, unperforated.
2. Felt Underlayment: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides, unperforated.
3. Roll Roofing Underlayment: ASTM D 6380, Class M, Type II, asphalt-saturated and -coated organic felt, mineral-granule surfaced.
4. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
5. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, a minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.

E. Snow Guards
1. Snow-Guard Pads: Fabricated copper **OR** cast-bronze **OR** zinc **OR** stainless-steel **OR** aluminum, **as directed**, units, designed to be installed without penetrating roof tiles, and complete with predrilled holes or hooks for anchoring.
2. Snow-Guard Rails: Units fabricated from metal baseplate anchored to adjustable **OR** fixed, **as directed**, bracket and equipped with two **OR** three, **as directed**, bars.
   a. Brackets and Baseplate: Aluminum **OR** Bronze or brass **OR** Stainless steel, **as directed**.
   b. Bars: Aluminum, mill finished **OR** Aluminum, clear anodized **OR** Stainless steel, mill finished, **as directed**.

F. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.

2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
   a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope tile roofing and 6 inches (152 mm) up the vertical surface.
   b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
   c. Channel Flashings: Fabricate with vertical surface extending a minimum of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, above the clay roof tile and 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
   d. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches (152 mm) beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
   e. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope tile roofing, 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.
   f. Closed **OR** Open, **as directed**,-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m), with 1-inch- (25-mm-) high, inverted-V profile at center of valley and with equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
   g. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m), with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Sheet Metal Ridge Vent: Fabricate from 16-oz./sq. ft.- (0.55-mm-) thick copper sheet, terminating each side in V-shaped external baffles with venting holes producing net-free ventilating area of 2.65 sq. in./ft. (56 sq. cm/m).
4. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation
1. General: Comply with clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
   a. Cover ridge **OR** hip, **as directed**, wood nailers with underlayment strips.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.

b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.

4. Double-Layer Felt/Roll Roofing Underlayment:
   a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   b. Install roll roofing underlayment, in parallel courses, in same direction as felt underlayment. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm).
      1) Mechanically fasten over felt underlayment.
      2) Adhere to felt underlayment with solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature **OR** uniform coating of cold-applied adhesive **OR** uniform coating of asphalt roofing cement, **as directed**.
   c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against chimneys, sidewalls, curbs, and other projections.
5. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
   a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
   b. Extend self-adhering sheet underlayment over entire roof deck.
      OR
      Extend self-adhering sheet underlayment over roof deck as follows:
      1) Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
      2) Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
      3) Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
      4) Hips: Extend 18 inches (455 mm) on each side.
      5) Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
      6) Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
      7) Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
      8) Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
6. Double-Layer Felt/Self-Adhering Sheet Underlayment:
   a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   b. Install self-adhering sheet underlayment, wrinkle free, on felt underlayment. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Lap sides not less than 3-1/2 inches (89 mm) in direction to shed water. Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
7. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
   a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).

B. Metal Flashing Installation
1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Install metal flashings according to clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.
5. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
   a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
   b. Adhere 9-inch- (230-mm-) wide strips of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
6. Channel Flashings: Install over underlayment and fasten to roof deck.
7. Rake Pan Flashings: Install over underlayment and fasten to roof deck.
8. Rake Drip Edges: Install over underlayment and fasten to roof deck.
9. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
10. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.
11. Sheet Metal Ridge Vents: Install centrally, and mechanically fasten to wood ridge. Adhere each side to clay roof tile with elastomeric sealant.
    a. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.

C. Wood Nailers And Battens, **as directed**
1. Install wood nailers at ridges **OR** hips **OR** rakes, **as directed**, and securely fasten to roof deck.
2. Install beveled wood cant at eaves and securely fasten to roof deck.
3. Install nominal 1-by-2-inch (25-by-50-mm) wood battens horizontally over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips **OR** in 48-inch (1200-mm) lengths with ends separated by 1/2 inch (13 mm), **as directed**, at spacing required by clay roof tile manufacturer, and securely fasten to roof deck.
   a. Install nominal 1-by-2-inch (25-by-50-mm) wood counter battens vertically spaced 24 inches (610 mm) apart and securely fasten to roof deck.

D. Clay Roof Tile Installation
1. General: Install clay roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."
   a. Maintain uniform exposure and coursing of clay roof tiles throughout roof.
   b. Extend tiles 2 inches (50 mm) over eave fasciae.
   c. Nail Fastening: Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.
      1) Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
   d. Wire-Tie Fastening: Install wire-tie systems and fasten clay roof tiles according to manufacturer's written instructions.
   e. Foam-Adhesive **OR** Mortar, **as directed**, Setting: Install clay roof tile according to TRI/FRSA's "Concrete and Clay Roof Tile Installation Manual."
   f. Install storm clips to capture edges of longitudinal sides of clay roof tiles and securely fasten to roof deck.

g. Install clay roof tile locks to support and lock overlying tile butts to underlying tiles.
h. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
i. Install clay roof tiles with color blend approved by the Owner.

2. Flat Shingle Clay Roof Tile Installation:
   a. Maintain 2-inch (50-mm) head lap between succeeding courses of clay roof tiles.
   b. Offset joints by half the clay roof tile width in succeeding courses.
   c. Extend clay roof tiles 1 inch (25 mm) over fasciae at rakes.
   d. Install ridge tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Close voids where ridge tiles meet clay roof tiles with ridge closure tiles **OR** mortar struck with face of ridge cover tiles, **as directed**.
   e. Install hip tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.

3. Flat Interlocking Clay Roof Tile Installation:
   a. Provide minimum 3-inch (75-mm) lap between succeeding courses of clay roof tiles.
   b. Offset joints by half the clay roof tile width in succeeding courses.
   c. Install L-shaped rake tiles.
   d. Install ridge tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Close voids where ridge tiles meet clay roof tiles with ridge closure tiles **OR** mortar struck with face of ridge cover tiles, **as directed**.
   e. Install hip tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.

4. Low-Profile, Interlocking Clay Roof Tile Installation:
   a. Provide minimum 3-inch (75-mm) lap between succeeding courses of clay roof tiles.
   b. Install L-shaped rake tiles.
   c. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.

5. High-Profile Clay Roof Tile Installation:
   a. Install tile **OR** sheet metal **OR** EPDM, **as directed**, eave closure.
   b. Provide minimum 3-inch (75-mm) lap between succeeding courses of clay roof tiles.
   c. Install L-shaped **OR** roll, **as directed**, rake tiles.
   d. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.

6. Open Valleys: Cut clay roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
   a. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
   b. Do not nail tiles to metal flashings.

7. Closed Valleys: Cut clay roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/4 to 1 inch (19 to 25 mm), **as directed**.
   a. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
   b. Do not nail tiles to metal flashings.

E. Snow-Guard Installation
   1. Snow-Guard Pads: Install rows of snow-guard pads at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from

gutter. Space snow guards apart in each row, offsetting by half this dimension between succeeding rows.

2. Snow-Guard Rails: Install rows of snow-guard rails at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter.

F. Adjusting And Cleaning
   1. Remove and replace damaged or broken clay roof tiles.
   2. Remove excess clay roof tiles and debris from Project site.

END OF SECTION 07 32 13 00

SECTION 07 32 16 00 - CONCRETE ROOF TILES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for concrete roof tiles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Concrete roof tiles.
b. Underlayment.
c. Snow guards.

C. Definitions
1. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Test Reports for Credit SS 7.2: For concrete roof tiles, documentation indicating compliance with Solar Reflectance Index requirement.
3. Samples: For each type of concrete roof tile and accessory tile indicated.
4. Material test reports.
5. Research/evaluation reports.
6. Maintenance data.
7. Warranties: Sample of special warranties.

E. Quality Assurance
1. Fire-Test-Response Characteristics: Provide concrete roof tiles and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
a. Exterior Fire-Test Exposure: Class A **OR** Class B **OR** Class C, **as directed**; UL 790 or ASTM E 108, for application and roof slopes indicated.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty
1. Special Warranty: Standard form in which manufacturer agrees to repair or replace concrete roof tiles that fail in materials within specified warranty period.
a. Materials-Only Warranty Period: 50 years from date of Final Completion.

1.2 PRODUCTS

A. Concrete Roof Tiles
1. Concrete Roof Tiles: ASTM C 1492, molded- or extruded-concrete roof tile units of shape and configuration indicated, with integral color, and free of surface imperfections. Provide with fastening holes prepunched at factory.
   a. Weight: Normal **OR** Medium **OR** Light, **as directed**.
   b. High-Profile Shape: Type I, Spanish or "S".
   c. Medium-Profile Shape: Type II, French interlocking.
   d. Low-Profile Shape: Type III, flat shingle **OR** Type III, flat interlocking, **as directed**.
   e. Side Configuration: Interlocking **OR** Noninterlocking, **as directed**.
   f. Solar Reflectance Index: Provide concrete roof tiles with Solar Reflectance Index not less than 29 when calculated according to ASTM E 1980, based on testing of identical products by a qualified testing agency.
   g. Colors, Blends, and Patterns: As selected from manufacturer's full range.
   h. Finish and Texture: Matte, smooth **OR** Matte, striated **OR** Glazed, smooth, **as directed**.
   i. Color: Brown **OR** White **OR** Red **OR** Pale red **OR** Green **OR** Gray **OR** Buff, **as directed**.
   j. High **OR** Medium, **as directed**,-Profile-Shape Accessory Tiles: Ridge, ridge vent, ridge end, hip and hip starter, header course, L-shaped rake edge, roll rake edge, starter, end band, and terminal, **as directed**, units, in color matching concrete roof tiles.
   k. Low-Profile-Shape Accessory Tiles: Ridge and closed ridge end, hip and hip starter, header course, L-shaped rake edge, starter, end band, and terminal, **as directed**, units, in color matching concrete roof tiles.

B. Accessories
1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** silicone, **as directed**,-based joint sealant; Type M **OR** Type S, **as directed**, Grade NS, Class 25, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.
4. Roofing Asphalt: ASTM D 312, Type IV.
5. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
6. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended for application by concrete roof tile manufacturer.
   OR
   Mortar: ASTM C 270, Type M, natural color **OR** with ASTM C 979, pigmented mortar matching the color of concrete roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar, **as directed**.
7. Eave Closure: Manufacturer's standard EPDM **OR** copper **OR** stainless-steel **OR** galvanized-steel **OR** aluminum, mill finish, **as directed**, eave closure formed to shape of concrete roof tiles.
8. Ridge Closure: Manufacturer's standard EPDM ridge closure, formed to shape of concrete roof tiles.
9. Wood Nailers, Beveled Cant Strips and Wood Battens: Comply with requirements for pressure-preservative-treated wood in Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.
10. Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) mesh of PVC-coated, glass-fiber thread.

C. Fasteners
1. Roofing Nails: ASTM F 1667, copper, 0.135-inch- (3.4-mm-) **OR** aluminum, 0.1055-inch- (2.7-mm-) **OR** hot-dip galvanized-steel, 0.1055-inch- (2.7-mm-), **as directed**, diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch- (10-mm-) diameter head; of sufficient length to penetrate 3/4 inch (19 mm) into wood battens **OR** solid-wood decking **OR** roof-deck sheathing, **as directed**.

a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

2. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
3. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.
4. Wire Ties: Copper **OR** Brass **OR** Stainless steel, **as directed**, 0.083-inch (2.1-mm) minimum diameter.
5. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed 6 inches (152 mm) apart, minimum 0.1-inch- (2.5-mm-) diameter brass wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.1-inch- (2.5-mm-) diameter copper wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.083-inch- (2.1-mm-) diameter stainless-steel wire and 0.037-inch- (0.94-mm-) diameter stainless-steel tie wires **OR** 0.083-inch- (2.1-mm-) diameter galvanized-steel wire and 0.037-inch- (0.94-mm-) diameter galvanized-steel tie wires, **as directed**, with matching-metal folding clip anchors.
6. Hook Nails: One-piece wind lock and concrete roof tile fastener system, minimum 0.1-inch- (2.5-mm-) diameter brass **OR** 0.09-inch- (2.3-mm-) diameter galvanized-steel, **as directed**, wire, for direct deck nailing.
7. Tile Locks: Brass **OR** Copper **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, 0.1-inch- (2.5-mm-) diameter wire device designed to secure butt edges of overlaid concrete roof tiles.
8. Storm Clips: Brass **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, strap-type, 0.04-by-1/2-inch (1.0-by-13-mm), L-shaped retainer clips designed to secure side edges of concrete roof tiles. Provide with two fastener holes in base flange.

D. Underlayment Materials
1. Felt Underlayment: ASTM D 226, Type II, asphalt-saturated organic felt, unperforated.
2. Felt Underlayment: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides, unperforated.
3. Roll Roofing Underlayment: ASTM D 6380, Class M, Type II, asphalt-saturated and -coated organic felt, mineral-granule surfaced.
4. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
5. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.

E. Snow Guards
1. Snow-Guard Pads: Fabricated copper **OR** cast-bronze **OR** zinc **OR** stainless-steel **OR** aluminum, **as directed**, units, designed to be installed without penetrating roof tiles, and complete with predrilled holes or hooks for anchoring.
2. Snow-Guard Rails: Units fabricated from metal baseplate anchored to adjustable **OR** fixed, **as directed**, bracket and equipped with two **OR** three, **as directed**, bars.
   a. Brackets and Baseplate: Aluminum **OR** Bronze or brass **OR** Stainless steel, **as directed**.
   b. Bars: Aluminum, mill finished **OR** Aluminum, clear anodized **OR** Stainless steel, mill finished, **as directed**.

F. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.

2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
   a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope tile roofing and 6 inches (152 mm) up the vertical surface.
   b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
   c. Channel Flashings: Fabricate with vertical surface extending a minimum of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, above the concrete roof tile and 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
   d. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches (152 mm) beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
   e. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope tile roofing, 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.
   f. Closed **OR** Open, **as directed**,-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m), with 1-inch- (25-mm-) high, inverted-V profile at center of valley and with equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
   g. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m), with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation
1. General: Comply with concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
   a. Cover ridge **OR** hip, **as directed**, wood nailers with underlayment strips.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
   b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.

4. Double-Layer Felt/Roll Roofing Underlayment:
   a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   b. Install roll roofing underlayment, in parallel courses, in same direction as felt underlayment. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm).
      1) Mechanically fasten over felt underlayment.
      2) Adhere to felt underlayment with solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature **OR** uniform coating of cold-applied adhesive **OR** uniform coating of asphalt roofing cement, **as directed**.
   c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against chimneys, sidewalls, curbs, and other projections.
5. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
   a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
   b. Extend self-adhering sheet underlayment over entire roof deck.
      OR
      Extend self-adhering sheet underlayment over roof deck as follows:
      1) Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
      2) Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
      3) Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
      4) Hips: Extend 18 inches (455 mm) on each side.
      5) Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
      6) Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
      7) Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
      8) Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
6. Double-Layer Felt/Self-Adhering Sheet Underlayment:
   a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
   b. Install self-adhering sheet underlayment, wrinkle free, on felt underlayment. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Lap sides not less than 3-1/2 inches (89 mm) in direction to shed water. Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
7. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
   a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).

B. Metal Flashing Installation

1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
   a. Install metal flashings according to concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.
5. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
   a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
   b. Adhere 9-inch- (230-mm-) wide strips of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
6. Channel Flashings: Install over underlayment and fasten to roof deck.
7. Rake Pan Flashings: Install over underlayment and fasten to roof deck.
8. Rake Drip Edges: Install over underlayment and fasten to roof deck.
9. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
10. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.
11. Sheet Metal Ridge Vents: Install centrally, and mechanically fasten to wood ridge. Adhere each side to concrete roof tile with elastomeric sealant.
    a. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.

C. Wood Nailers And Battens, **as directed**
1. Install wood nailers at ridges **OR** hips **OR** rakes, **as directed**, and securely fasten to roof deck.
2. Install beveled wood cant at eaves and securely fasten to roof deck.
3. Install nominal 1-by-2-inch (25-by-50-mm) wood battens horizontally over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips **OR** in 48-inch (1200-mm) lengths with ends separated by 1/2 inch (13 mm), **as directed**, at spacing required by concrete roof tile manufacturer, and securely fasten to roof deck.
   a. Install nominal 1-by-2-inch (25-by-50-mm) wood counter battens vertically spaced 24 inches (610 mm) apart and securely fasten to roof deck.

D. Concrete Roof Tile Installation
1. General: Install concrete roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."
   a. Maintain uniform exposure and coursing of concrete roof tiles throughout roof.
   b. Extend tiles 2 inches (50 mm) over eave fasciae.
   c. Nail Fastening: Drive nails to clear the concrete roof tile so the tile hangs from the nail and is not drawn up.
      1) Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
   d. Wire-Tie Fastening: Install wire-tie systems and fasten concrete roof tiles according to manufacturer's written instructions.
   e. Foam-Adhesive **OR** Mortar, **as directed**, Setting: Install concrete roof tiles according to TRI/FRSA's "Concrete and Clay Roof Tile Installation Manual."
   f. Install storm clips to capture edges of longitudinal sides of concrete roof tiles and securely fasten to roof deck.
   g. Install concrete roof tile locks to support and lock overlying tile butts to underlying tiles.

h. Cut and fit concrete roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
i. Install concrete roof tiles with color blend approved by the Owner.

2. Flat Shingle Concrete Roof Tile Installation:
   a. Maintain 2-inch (50-mm) head lap between succeeding courses of concrete roof tiles.
   b. Offset joints by half the concrete roof tile width in succeeding courses.
   c. Extend concrete roof tiles 1 inch (25 mm) over fasciae at rakes.
   d. Install ridge tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Close voids where ridge tiles meet concrete roof tiles with ridge closure tiles **OR** mortar struck with face of ridge cover tiles, **as directed**.
   e. Install hip tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Fill voids with mortar where hip tiles meet concrete roof tiles, and strike mortar flush with face of hip cover tiles.

3. Flat Interlocking Concrete Roof Tile Installation:
   a. Provide minimum 3-inch (75-mm) lap between succeeding courses of concrete roof tiles.
   b. Offset joints by half the concrete roof tile width in succeeding courses.
   c. Install L-shaped rake tiles.
   d. Install ridge tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Close voids where ridge tiles meet concrete roof tiles with ridge closure tiles **OR** mortar struck with face of ridge cover tiles, **as directed**.
   e. Install hip tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
      1) Fill voids with mortar where hip tiles meets concrete roof tiles, and strike mortar flush with face of hip cover tiles.

4. Low-Profile, Interlocking Concrete Roof Tile Installation:
   a. Provide minimum 3-inch (75-mm) lap between succeeding courses of concrete roof tiles.
   b. Install L-shaped rake tiles.
   c. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.

5. High-Profile Concrete Roof Tile Installation:
   a. Install tile **OR** sheet metal **OR** EPDM, **as directed**, eave closure.
   b. Provide minimum 3-inch (75-mm) lap between succeeding courses of concrete roof tiles.
   c. Install L-shaped **OR** roll, **as directed**, rake tiles.
   d. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.

6. Open Valleys: Cut concrete roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
   a. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
   b. Do not nail tiles to metal flashings.

7. Closed Valleys: Cut concrete roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/4 to 1 inch (19 to 25 mm), **as directed**.
   a. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
   b. Do not nail tiles to metal flashings.

E. Snow-Guard Installation
   1. Snow-Guard Pads: Install rows of snow-guard pads at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter. Space snow guards apart in each row, offsetting by half this dimension between succeeding rows.

2. Snow-Guard Rails: Install rows of snow-guard rails at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter.

F. Adjusting And Cleaning
1. Remove and replace damaged or broken concrete roof tiles.
2. Remove excess concrete roof tiles and debris from Project site.

END OF SECTION 07 32 16 00

Task	Specification	Specification Description
07 34 00 00	07 31 13 13	Asphalt Shingles
07 34 00 00	07 31 16 00	Metal Shingles
07 34 00 00	07 31 26 00	Slate Shingles
07 34 00 00	07 31 29 13	Wood Shingles And Shakes
07 34 00 00	07 32 13 00	Clay Roof Tiles

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SECTION 07 41 13 00 - METAL ROOF PANELS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for metal roof panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Exposed-fastener, lap-seam metal roof panels.
b. Concealed-fastener, lap-seam metal roof panels.
c. Standing-seam metal roof panels.
d. Batten-seam metal roof panels.
e. Horizontal-seam (Bermuda-type) metal roof panels.
f. Foamed-insulation-core metal roof panels.
g. Metal soffit panels.

C. Definitions
1. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

D. Performance Requirements
1. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
a. Test-Pressure Difference (for roofs with slopes of 30 degrees or less): Negative 1.57 lbf/sq. ft. (75 Pa).
b. Test-Pressure Difference (for roofs with slopes steeper than 30 degrees): Positive and negative 1.57 lbf/sq. ft. (75 Pa).
c. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
d. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
4. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
a. Test-Pressure Difference (for roofs with slopes of 30 degrees or less): 2.86 lbf/sq. ft. (137 Pa).
b. Test-Pressure Difference (for roofs with slopes steeper than 30 degrees): 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12.0 lbf/sq. ft. (575 Pa).
c. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
d. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

5. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
6. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   a. Uplift Rating: UL 30 **OR** UL 60 **OR** UL 90, **as directed**.
7. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed**.
   b. Hail Resistance: MH **OR** SH, **as directed**.
8. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
   a. Wind Loads: Determine loads based on the following minimum design wind pressures:
      1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
         OR
         Uniform pressure as indicated on Drawings.
   b. Snow Loads: 25 lbf/sq. ft. (1197 Pa) **OR** 30 lbf/sq. ft. (1436 Pa) **OR** 35 lbf/sq. ft. (1676 Pa), **as directed**.
   c. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.
9. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
10. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.
11. Energy Performance
    a. Provide roof panels with solar reflectance index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
       OR
       Energy Performance: Provide roof panels that are listed on the U.S. Department of Energy's ENERGY STAR Roof Products Qualified Product List for low-slope **OR** steep-slope, **as directed**, roof products.
       OR
       Energy Performance: Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
   a. Product Test Reports for Credit SS 7.2: For roof panels, indicating that panels comply with solar reflectance index requirement.
   b. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.
      1) Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
4. Samples: For each type of exposed finish required.

5. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   a. Snow Retention System Calculations: Include calculation of number and location of snow guards based on snow load, roof slope, panel length and finish, and seam type and spacing.
6. Coordination Drawings: Roof plans, drawn to scale, based on input from installers of the items involved.
7. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
   a. Submit evidence of meeting performance requirements.
8. Product test reports.
9. Field quality-control reports.
10. Maintenance data.
11. Warranties: Samples of special warranties.

F. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Surface-Burning Characteristics: Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
3. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
   b. Combustion Characteristics: ASTM E 136.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
2. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.
5. Protect foam-plastic insulation as follows:
   a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
   c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within two years from date of Final Completion.

2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within 10 **OR** 20, **as directed**, years from date of Final Completion.
3. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within five **OR** 10, **as directed**, years from date of Final Completion.
4. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within 20 years from date of Final Completion.

1.2 PRODUCTS

A. Panel Materials
1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
   b. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   c. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
   d. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   e. Exposed Coil-Coated Finish:
      1) 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      2) 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3) 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      4) Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      5) Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      6) FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
      8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.

f. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   b. Exposed Coil-Coated Finish:
      1) 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      2) 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3) 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      4) Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      5) Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      6) FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
      8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
   c. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
   a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings:
      1) Natural finish.
      2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
      3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
         a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
      4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally formed patina.

4. Panel Sealants:

a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

B. Field-Installed Thermal Insulation
1. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
2. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (240 kPa), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed.
3. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 aluminum foil **OR** Type II, Class 1 or 2 felt or glass-fiber mat, Grade 3 **OR** Type V, oriented-strand-board facing, **as directed**, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.
4. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.
5. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (15 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.
6. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).
7. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
   a. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
   b. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
   c. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
8. Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202 **OR** ASTM C 991, Type II, **as directed**, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
   a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:
      1) Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing **OR** Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating **OR** Polypropylene faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and polyester backing, **as directed**.
   b. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed, galvanized-steel or PVC retainer clips colored to match insulation facing.
   c. Thermal Spacer Blocks: Fabricated from extruded polystyrene, 1 inch (25 mm) thick.

C. Underlayment Materials
1. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.

b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

2. Felts: ASTM D 226, Type II (No. 30) **OR** Type I (No. 15), **as directed**, asphalt-saturated organic felts.

3. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

D. Substrate Boards

1. Gypsum Board: Type X, of thickness indicated, with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges. ASTM C 1396/C 1396M.

2. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M; Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**.

3. Perlite Board: ASTM C 728, 1 inch (25 mm) thick.

4. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

E. Miscellaneous Metal Framing

1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.

2. Hat-Shaped, Rigid Furring Channels:
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
   b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.

3. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
   b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
   c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
   d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

4. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm), **as directed**.

5. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

F. Miscellaneous Materials

1. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Exposed-Fastener, Lap-Seam Metal Roof Panels

1. General: Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

2. Corrugated-Profile, Exposed-Fastener Metal Roof Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by Architect from manufacturer's full range.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by Architect from manufacturer's full range.

d. Panel Coverage: 21.3 inches (541 mm) **OR** 29.3 inches (744 mm) **OR** 34.67 inches (881 mm) **OR** 37.3 inches (947 mm) **OR** 42.67 inches (1084 mm) **OR** 45.3 inches (1151 mm), **as directed**.

e. Panel Height: 0.5 inch (13 mm) **OR** 0.875 inch (22 mm), **as directed**.

3. Tapered-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
   1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.

e. Major-Rib Spacing: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm), **as directed**, o.c.

f. Panel Coverage: 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.

g. Panel Height: 0.625 inch (16 mm) **OR** 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.

4. Vee-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Rib Spacing: 5.3 inches (135 mm) **OR** 7.2 inches (183 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
   e. Panel Coverage: 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**.
   f. Panel Height: 1.375 inches (35 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.
5. Box-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Rib Spacing: 2.67 inches (68 mm) **OR** 4.0 inches (102 mm) **OR** 5.3 inches (135 mm) **OR** 6.0 inches (152 mm), **as directed**, o.c.
   e. Panel Coverage: 24 inches (610 mm) **OR** 28 inches (711 mm) **OR** 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm), **as directed**.

f. Panel Height: 0.625 inch (16 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.

6. Deep-Box-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Rib Spacing: 12 inches (305 mm), **as directed**, o.c.
   e. Panel Coverage: 24 inches (610 mm), **as directed**.
   f. Panel Height: 3 inches (76 mm) **OR** 4 inches (102 mm).**as directed**.

H. Concealed-Fastener, Lap-Seam Metal Roof Panels
1. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Tapered-Rib-Profile, Concealed-Fastener Metal Roof Panels: Formed with raised, trapezoidal major rib at panel edge and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major rib and panel edge.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.

d. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm), **as directed**.

3. Standing-Seam-Profile, Concealed-Fastener Metal Roof Panels: Formed with raised, curved-top, standing-seam-shaped major rib at panel edge and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major rib and panel edge.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
      1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
   e. Panel Coverage: 10 inches (254 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
   f. Panel Height: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.

4. Batten-Seam-Profile, Concealed-Fastener Metal Roof Panels: Formed with raised, batten-seam-shaped major rib at panel edge and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major rib and panel edge.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Panel Coverage: 10 inches (254 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.

e. Panel Height: 0.75 inch (19 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
f. Batten Width: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.

I. Standing-Seam Metal Roof Panels
1. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
a. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
b. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.
2. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.
a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As selected by the Owner from manufacturer's full range.
b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As selected by the Owner from manufacturer's full range.
c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As selected by the Owner from manufacturer's full range.
d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**,.
1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
e. Batten: Same material, finish, and color as roof panels.
f. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
g. Panel Coverage: 10 inches (254 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
h. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm), **as directed**.
3. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
   1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.

e. Batten: Same material, finish, and color as roof panels.

f. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
   1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
   2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.

g. Joint Type: Single folded **OR** Double folded **OR** As standard with manufacturer, **as directed**.

h. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 20 inches (508 mm) **OR** 24 inches (610 mm), **as directed**.

i. Panel Height: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm), **as directed**.

4. Trapezoidal-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 28-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

c. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
   1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

d. Panel Coverage: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
e. Panel Height: 3 inches (76 mm).

5. Trapezoidal-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
      1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
   d. Joint Type: Single folded **OR** Double folded **OR** As standard with manufacturer, **as directed**.
   e. Panel Coverage: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
   f. Panel Height: 2.7 inches (69 mm) **OR** 3.0 inches (76 mm), **as directed**.

6. Integral-Standing-Seam Metal Roof Panels: Formed with integral ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
      1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
   e. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.

1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.

f. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.

g. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.

J. Batten-Seam Metal Roof Panels

1. General: Provide factory-formed metal roof panel assembly designed to be installed by covering vertical side edges of adjacent panels with battens and mechanically attaching panels to supports using concealed clips. Include battens and accessories required for weathertight installation.
2. Narrow-Profile, Snap-on-Batten-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located under 1 side of panels and engaging opposite edge of adjacent panels, and installation of 3/8-to-1/2-inch- (10-to-13-mm-) wide, snap-on battens over panel joints.
   a. Panel Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Panel Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Panel Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Panel Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
      1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
   e. Batten Material: Same material, finish, and color as roof panels.
   f. Clips: One **OR** Two, **as directed**, piece.
      1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed,** nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
      2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
   g. Sealant: Factory applied in top **OR** on each side, **as directed**, of battens.
   h. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 20 inches (508 mm), **as directed**.
   i. Batten Height: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm), **as directed**.
3. Wide-Profile, Snap-on-Batten-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and installing snap-on battens over panel joints.

a. Panel Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

b. Panel Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

c. Panel Material: Aluminum sheet, 0.024 inch (0.061 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

d. Panel Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
   1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.

e. Batten Material: Same material, finish, and color as roof panels.

f. Clips: One piece.
   1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
   2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.

g. Sealant: Factory applied on each side of battens.

h. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 22 inches (559 mm) **OR** 24 inches (610 mm), **as directed**.

i. Batten Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 1.88 inches (48 mm) **OR** 2.0 inches (51 mm), **as directed**.

4. Seamed-Batten Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** smooth, flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and installing mechanically seamed battens over panel joints.

a. Panel Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

b. Panel Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

c. Panel Material: Aluminum sheet, 0.024 inch (0.061 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As selected by the Owner from manufacturer's full range.

d. Panel Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
   1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
e. Batten Material: Same material, finish, and color as roof panels.
f. Clips: One **OR** Two, **as directed**, piece.
   1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
   2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
g. Sealant: Factory applied on each side of clips under battens.
h. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
i. Batten Height: 2.0 inches (51 mm) **OR** 2.375 inches (60 mm) **OR** 3.0 inches (76 mm), **as directed**.

K. Horizontal-Seam (Bermuda-Type) Metal Roof Panels
1. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Formed with horizontal seam at panel edges and smooth, flat pan; designed to be installed in sequential installation by engaging lower edge of each panel to upper edge of panel below and mechanically attaching panels to supports using concealed clips located under upper edge of panels.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer, **as directed**.
      2) Color: As selected by the Owner from manufacturer's full range.
   d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
      1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
   e. Clips: One piece.
      1) Material: 0.028-inch- (0.71-mm-) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
      2) Material: 0.025-inch- (0.64-mm-) thick, stainless-steel sheet.
   f. Seal: Factory-applied sealant or vinyl weatherseal in seam.
   g. Exposure: 9.5 inches (241 mm) **OR** 11 inches (279 mm), **as directed**, nominal.
   h. Seam Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.

L. Foamed-Insulation-Core Metal Roof Panels
1. General: Provide factory-formed and -assembled metal roof panels fabricated from two sheets of metal with insulation core foamed-in-place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
   a. Panel Performance:
      1) Flatwise Tensile Strength: 30 psi (200 kPa) when tested according to ASTM C 297/C 297M.

2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.
4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
7) Fire-Test-Response Characteristics: Class A according to ASTM E 108.

b. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
1) Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
2) Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
3) Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D 1621.
4) Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273.

2. Lap-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.
a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
a) Color: As selected by the Owner from manufacturer's full range.
4) Interior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
a) Color: As selected by the Owner from manufacturer's full range.

b. Batten: Same material, finish, and color as exterior facings of roof panels.
c. Panel Coverage: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 39.6 inches (1000 mm) **OR** 40 inches (1016 mm) **OR** 44.5 inches (1130 mm), **as directed**.
d. Panel Thickness: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.

3. Standing-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed with vertical tongue-and-groove ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and mechanically seaming panels together.
a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.

2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
a) Color: As selected by the Owner from manufacturer's full range.
4) Interior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
a) Color: As selected by the Owner from manufacturer's full range.

b. Joint Type: Single folded **OR** Double folded **OR** As standard with manufacturer, **as directed**.
c. Panel Coverage: 36 inches (914 mm) **OR** 42 inches (1067 mm), **as directed**.
d. Panel Thickness: 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.

4. Batten-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed with vertical or tapered tongue-and-groove ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and installing snap-on battens over panel joints.
a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) nominal thickness.
2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) nominal thickness.
3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
a) Color: As selected by the Owner from manufacturer's full range.
4) Interior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
a) Color: As selected by the Owner from manufacturer's full range.

b. Batten: Same material, finish, and color as exterior facings of roof panels.
c. Clips: One piece; 0.064-inch- (1.63-mm-) **OR** 0.097-inch- (2.50-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
d. Panel Coverage: 36 inches (914 mm) **OR** 39.6 inches (1000 mm), **as directed**.
e. Panel Thickness: 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.

M. Metal Soffit Panels
1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Metal Soffit Panels: Match profile and material of metal roof panels.
a. Finish: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As indicated on Drawings, **as directed**.
b. Sealant: Factory applied within interlocking joint.
3. Flush-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
a. Material: Same material, finish, and color as metal roof panels.

b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

c. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
   1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.

f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.

g. Panel Height: 0.875 inch (22 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 3.0 inches (76 mm), **as directed**.

h. Sealant: Factory applied within interlocking joint.

4. Reveal-Joint-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with recessed reveal joint between panels.
   a. Material: Same material, finish, and color as metal roof panels.
   b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
   c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
   1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.

f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.

g. Panel Height: 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.

5. V-Groove-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm),flat pan, **as directed**, between panel edges; with V-groove joint between panels.

a. Material: Same material, finish, and color as metal roof panels.

b. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

d. Material: Aluminum sheet, 0.024 inch (0.65 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.

e. Panel Coverage: 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.

f. Panel Height: 0.375 inch (10 mm) **OR** 0.44 inch (11 mm) **OR** 0.50 inch (13 mm) **OR** 0.625 inch (16 mm), **as directed**.

N. Accessories

1. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

a. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.

b. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

c. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

2. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch (0.45 mm) thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

3. Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels **OR** roof fascia and rake trim, **as directed**.

4. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.

5. Roof Curbs: Fabricated from same material as roof panels, minimum 0.048 inch (1.2 mm) thick; with bottom of skirt profiled to match roof panel profiles, and welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.

a. Insulate roof curb with 1-inch- (25-mm-) thick, rigid insulation.

O. Snow Guards

1. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.

a. Surface-Mounted, Plastic, Stop-Type Snow Guards: Clear **OR** Integral color, **as directed**, polycarbonate stops designed for attachment to pan surface of metal roof panels using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

b. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to pan surface of metal roof panel using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

c. Surface-Mounted, Copper, Stop-Type Snow Guards: Bronze-alloy stops designed for attachment to pan surface of copper roof panel using solder.

d. Seam-Mounted, Stop-Type Snow Guards: Cast-aluminum **OR** Malleable-iron **OR** Clear polycarbonate **OR** Colored polycarbonate, **as directed**, stops designed for attachment to vertical ribs of standing-seam metal roof panels with stainless-steel set screws.

e. Seam-Mounted, Bar-Type Snow Guards: Aluminum **OR** stainless-steel, **as directed**, rods or bars held in place by stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

1) Aluminum Finish: Mill **OR** Clear anodized, **as directed**.

2) Stainless-Steel Finish: Mill **OR** No. 2B **OR** No. 4, **as directed**.

P. Fabrication

1. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

2. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

3. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.
4. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   b. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   c. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   f. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

Q. Finishes
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation
1. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
2. Substrate Board: Install substrate boards over roof deck **OR** sheathing, **as directed**, on entire roof surface. Attach with substrate-board fasteners.
   a. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   b. Comply with UL **OR** FMG, **as directed**, requirements for fire-rated construction.
3. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.
   a. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

B. Underlayment Installation
1. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below **OR** on Drawings, a**s directed**, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   a. Roof perimeter for a distance up from eaves of 24 inches (600 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior wall line.

b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm), **as directed**. Overlap ends of sheets not less than 6 inches (150 mm).
c. Rake edges for a distance of 18 inches (460 mm).
d. Hips and ridges for a distance on each side of 12 inches (300 mm).
e. Roof to wall intersections for a distance from wall of 18 inches (460 mm).
f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).

2. Felt Underlayment: Apply at locations indicated below **OR** on Drawings, **as directed**, in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).
a. Apply over entire roof surface.
b. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
3. Apply slip sheet over underlayment before installing metal roof panels.
4. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing And Trim".

C. Thermal Insulation Installation
1. Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.
2. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation".
a. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches (600 mm) o.c.
3. Blanket Insulation: Install insulation concurrently with metal roof panel installation, in thickness indicated to cover entire roof, according to manufacturer's written instructions and as follows:
a. Set vapor-retarder-faced units with vapor retarder to warm side **OR** in location indicated, **as directed**, of construction unless otherwise indicated. Do not obstruct ventilation spaces.
b. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
c. Install blankets straight and true in one-piece lengths with both sets of facing tabs sealed. Comply with the following installation method:
1) Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.
2) Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlin, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
3) Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.
4) Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlins, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
d. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
e. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

D. Metal Roof Panel Installation, General
1. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
2. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.
   a. Point of Fixity: Fasten each panel along a single line of fixing located at eave **OR** ridge **OR** center of panel length **OR** locations indicated on Drawings, **as directed**.
   b. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
3. Install metal roof panels as follows:
   a. Commence metal roof panel installation and install minimum of 300 sq. ft. (27.8 sq. m.) in presence of factory-authorized representative.
   b. Field cutting of metal panels by torch is not permitted.
   c. Install panels perpendicular to purlins.
   d. Locate and space fastenings in uniform vertical and horizontal alignment.
   e. Provide metal closures at rake edges **OR** rake walls, **as directed**, and each side of ridge **OR** ridge and hip, **as directed**, caps.
   f. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
   g. Install ridge **OR** ridge and hip, **as directed**, caps as metal roof panel work proceeds.
   h. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
   i. Install metal flashing to allow moisture to run over and off metal roof panels.
4. Fasteners:
   a. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.
   b. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
   c. Copper Roof Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
5. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
6. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
   a. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
7. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
   a. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
   b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

E. Metal Roof Panel Installation
1. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   a. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   b. Lap ribbed or fluted sheets one full rib corrugation.
   c. Provide metal-backed neoprene or EPDM washers under heads of exposed fasteners bearing on weather side of metal roof panels.

d. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
e. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
f. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
g. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
h. At panel end splices, nest panels with minimum 6-inch (150-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

2. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
a. Install clips to supports with self-tapping fasteners.
b. Install pressure plates at locations indicated in manufacturer's written installation instructions.
c. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
d. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3. Batten-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each batten-seam joint at location, spacing, and with fasteners recommended by manufacturer.
a. Install clips to supports with self-drilling fasteners.
b. Apply battens to metal roof panel seams, fully engaged to provide weathertight joints.

4. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each horizontal-seam joint at location, spacing, and with fasteners recommended by manufacturer. Start at eave and work upward toward ridge.
a. Install clips to supports with self-drilling fasteners.

F. Foamed-Insulation-Core Metal Roof Panel Installation
1. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal roof panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
2. Lap-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
a. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
b. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of insulated metal roof panels.
c. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
d. Provide sealant tape at lapped joints of insulated metal roof panels and between panels and protruding equipment, vents, and accessories.
e. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weatherproof to driving rains.
f. Apply snap-on battens to insulated metal roof panel seams to conceal fasteners.

3. Standing-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
a. Install clips to supports with self-tapping fasteners.

b. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so cleat, insulated metal roof panel, and factory-applied side-lap sealant are completely engaged.

4. Batten-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each batten-seam joint at location, spacing, and with fasteners recommended by manufacturer.
   a. Apply battens to insulated metal roof panel seams, fully engaged to provide weathertight joints.

G. Metal Soffit Panel Installation
1. In addition to complying with requirements in "Metal Roof Panel Installation, General" Article, install metal soffit panels to comply with requirements in this article.
2. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
   a. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
3. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

H. Accessory Installation
1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   a. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
3. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
4. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
   a. Provide elbows at base of downspouts to direct water away from building.
   b. Connect downspouts to underground drainage system indicated.
5. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
6. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

I. Snow Guard Installation

1. Stop-Type Snow Guards: Attach snow guards to metal roof panels with adhesive, sealant, or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate metal roof panels.
   a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning from gutter, with each snow guard centered between panel ribs.
2. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with clamps or set screws. Do not use fasteners that will penetrate metal roof panels.
   a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning from gutter.

J. Erection Tolerances
1. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

K. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.
2. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
3. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

L. Cleaning
1. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
2. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00

SECTION 07 41 13 00a - SHEET METAL ROOFING

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for sheet metal roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Flat-seam metal roofing, custom fabricated.
b. Standing-seam metal roofing, custom fabricated **OR** on-site, roll formed, **as directed**.
c. Batten-seam metal roofing, custom fabricated **OR** on-site, roll formed, **as directed**.
d. Horizontal-seam (Bermuda-type) metal roofing, custom fabricated.

C. Performance Requirements
1. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, battens, **as directed**, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.
2. Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
3. Energy Performance: Provide metal roofing with solar reflectance index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Test Reports for Credit SS 7.2: For roof panels, indicating that panels comply with Solar Reflectance Index requirement.
3. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work.
a. Include details for forming, joining, and securing sheet metal roofing, including pattern of seams, termination points, fixed points, expansion joints, roof penetrations, edge conditions, special conditions, connections to adjoining work, and details of accessory items.
4. Samples: For each exposed product and for each finish specified.
5. Coordination Drawings: Roof plans drawn to scale with coordinated details for penetrations and roof-mounted items.
6. Portable Roll-Forming Equipment Certificate: Issued by UL for equipment manufacturer's portable roll-forming equipment capable of producing panels that comply with UL requirements.
7. Product test reports.
8. Maintenance data.
9. Warranties: Sample of special warranties.

E. Quality Assurance

1. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Fabricator authorized by portable roll-forming equipment manufacturer to fabricate and install sheet metal roofing units required for this Project, and who maintains current UL certification of its portable roll-forming equipment.
2. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for Class 30 **OR** Class 60 **OR** Class 90, **as directed**, wind-uplift resistance. Maintain UL certification of portable roll-forming equipment for duration of sheet metal roofing work.
3. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
4. Copper Roofing Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
5. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal roofing materials away from uncured concrete and masonry.
2. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal roofing installation.

G. Warranty
1. Special Warranty: Warranty form at the end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within two years from date of Final Completion.
2. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within 20 **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Roofing Sheet Metals
1. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
2. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
   c. Thickness: Nominal 0.022 inch (0.56 mm) **OR** 0.028 inch (0.71 mm), **as directed**, unless otherwise indicated.
      1) Batten Caps: Nominal 0.028 inch (0.71 mm) thick.
   d. Surface: Smooth, flat **OR** Embossed, **as directed**.
   e. Exposed Coil-Coated Finish:
      1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3) Four-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat,

and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4) Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

5) Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

6) FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mils (0.97 mm) for topcoat.

f. Color: As selected from manufacturer's full range.

g. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

3. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

a. Thickness: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, unless otherwise indicated.

1) Batten Caps: 0.050 inch (1.27 mm) thick.

b. As-Milled Finish: Mill **OR** One-side bright mill **OR** Standard one-side bright **OR** Standard two-side bright, **as directed**, finish.

c. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.

d. Surface: Smooth, flat **OR** Embossed, **as directed**.

e. Factory Prime Coating: Where painting after installation is indicated, pretreat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).

f. Exposed Coil-Coated Finish:

1) Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2) Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3) Four-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4) Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

5) Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight

in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

6) FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.

g. Color: As selected from manufacturer's full range.

h. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

4. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, 16 oz./sq. ft. (0.55 mm thick) **OR** 20 oz./sq. ft. (0.70 mm thick), **as directed**, unless otherwise indicated.

a. Batten Caps: 20 oz./sq. ft. (0.70 mm thick).

b. Non-Patinated Exposed Finish: Mill

c. Non-Patinated Exposed, Lacquered Finish: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

1) Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac" waterborne **OR** solvent-borne, **as directed**, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to a total thickness of 1 mil (0.025 mm).

2) Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac" waterborne **OR** solvent-borne, **as directed**, air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to a total thickness of 1 mil (0.025 mm).

d. Pre-Patinated Copper-Sheet Finish: Dark brown **OR** Verdigris, **as directed**, pre-patinated according to ASTM B 882.

5. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).

a. Weight (Thickness): 16-oz./sq. ft. (0.55-mm) **OR** 20-oz./sq. ft. (0.70-mm), **as directed**, uncoated weight (thickness), with 0.787-mil (0.020-mm) coating thickness applied to each side.

1) Batten Caps: 20-oz./sq. ft. (0.70-mm) uncoated weight (thickness), with 0.787-mil (0.020-mm) coating thickness applied to each side unless otherwise indicated.

6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.

a. Thickness: 0.016 inch (0.40 mm) **OR** 0.019 inch (0.48 mm), **as directed**, unless otherwise indicated.

1) Batten Caps: 0.019 inch (0.48 mm) thick.

b. Surface: Smooth, flat **OR** Embossed, **as directed**.

c. Finish: 2D (dull, cold rolled) **OR** 2B (bright, cold rolled) **OR** 3 (coarse, polished directional satin) **OR** 4 (polished directional satin), **as directed**.

1) Remove tool and die marks and stretch lines or blend into finish.

2) Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

3) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

7. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray preweathering.
   a. Thickness: 0.015-inch (0.38-mm) **OR** 0.018-inch (0.46-mm) **OR** 0.024-inch (0.61-mm), **as directed**, minimum uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side.
      1) Batten Caps: 0.018-inch- (0.46-mm-) minimum uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side unless otherwise indicated.
8. Zinc-Tin Alloy-Coated Steel Sheet: ASTM A 625/A 625M; single-reduced, black-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied shop coat, **as directed**.
   a. Thickness: 0.012-inch (0.31-mm) **OR** 0.014-inch (0.36-mm), **as directed**, uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side.
      1) Batten Caps: 0.014-inch (0.36-mm) uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side unless otherwise indicated.
   b. Exposed Coil-Coated Finish: Manufacturer's standard two-coat fluoropolymer complying with performance requirements in AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      1) Color: As selected from manufacturer's full range.
   c. Field-Applied Finish: Manufacturer's standard waterborne acrylic emulsion paint primer and finish coat.
      1) Color: As selected from manufacturer's full range.
9. Zinc Sheet: Zinc, 99 percent pure, alloyed with a maximum of 1 percent copper and titanium; with manufacturer's standard factory-applied, flexible, protective back coating.
   a. Thickness: 0.027 inch (0.70 mm) **OR** 0.032 inch (0.80 mm), **as directed**, unless otherwise indicated.
      1) Batten Caps: 0.032 inch (0.80 mm) thick.
   b. Finish: Bright rolled **OR** Preweathered gray **OR** Preweathered black, **as directed**.
10. Titanium Sheet: ASTM B 265, Grade 1.
   a. Thickness: 0.015 inch (0.38 mm) **OR** 0.020 inch (0.51 mm), **as directed**, unless otherwise indicated.
      1) Batten Caps: 0.020 inch (0.51 mm) thick.
   b. Surface: Smooth, flat **OR** Embossed, **as directed**.
   c. Finish: Low **OR** Medium, **as directed**, matte.
   d. Color Anodic Finish (Light-Interference Phenomenon): Silver **OR** Gold **OR** Purple **OR** Blue **OR** Match sample **OR** As selected from manufacturer's full range of colors and color densities, **as directed**.

B. Underlayment Materials
1. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
2. Felts: ASTM D 226, Type II (No. 30) **OR** Type I (No. 15), **as directed**, asphalt-saturated organic felts.
3. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   a. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
   b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
4. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

C. Miscellaneous Materials

1. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
2. Wood Battens: Lumber complying with requirements in Division 05 Section(s) "Maintenance Of Decorative Metal" OR Division 06 Section(s) "Miscellaneous Rough Carpentry", **as directed**, and treated with exterior-type fire retardant.
3. Snap-On Seams: Provide snap-on seams integrated with panel-edge profile as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
4. Snap-on Batten Caps: Provide batten clips integrated with snap-on caps as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
5. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   a. General:
      1) Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
      2) Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      3) Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   b. Fasteners for Zinc-Coated **OR** Aluminum-Zinc Alloy-Coated, a**s directed**, Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.
   c. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   d. Fasteners for Copper **OR** Zinc-Tin Alloy-Coated Copper, **as directed**, Sheet: Copper, hardware bronze, or Series 300 stainless steel.
   e. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   f. Fasteners for Zinc-Tin Alloy-Coated Steel **OR** Stainless-Steel, **as directed**, Sheet: Series 300 stainless steel.
   g. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.
   h. Fasteners for Titanium Sheet: Titanium or Series 300 stainless steel.
6. Solder:
   a. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
   b. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
   c. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
   d. For Zinc-Tin Alloy-Coated Steel **OR** Stainless Steel **OR** Copper, **as directed**: ASTM B 32, 100 percent tin.
   e. For Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by manufacturer.
7. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
8. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed**, polymer sealant as recommended by portable roll-forming equipment manufacturer for installation indicated, **as directed**; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
9. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

10. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Accessories
1. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
   a. Provide accessories as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
   b. Cleats: For mechanically seaming into joints and formed from the following materials:
      1) Metallic-Coated Steel **OR** Aluminum, **as directed**, Roofing: 0.0250-inch- (0.64-mm-), **as directed**, thick stainless steel.
      2) Copper **OR** Zinc-Tin Alloy-Coated Copper, **as directed**, Roofing: 16-oz./sq. ft. (0.55-mm), **as directed**, copper sheet.
      3) Stainless-Steel **OR** Titanium, **as directed**, Roofing: 0.0250-inch- (0.64-mm-), **as directed**, thick stainless steel.
      4) Zinc-Tin Alloy-Coated Stainless-Steel **OR** Zinc-Tin Alloy-Coated Steel, **as directed**, Roofing: Manufacturer's preformed cleats or cleats fabricated from manufacturer's thickest flat-stock sheet.
      5) Zinc Roofing: Manufacturer's preformed stainless-steel cleats.
   c. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
   d. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
   e. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
   f. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch (0.46 mm) thick.
2. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
3. Roof Curbs: Fabricated from same material and finish as sheet metal roofing, minimum thickness matching the sheet metal roofing; with bottom of skirt profiled to match roof panel profiles; with weatherproof top box and integral full-length cricket. Fabricate curb subframing of nominal 0.062-inch- (1.59-mm-) thick, angle-, C-, or Z-shaped galvanized steel or stainless-steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   a. Insulate curbs with 1-inch- (25-mm-) thick, rigid insulation.
   b. Install wood nailers at tops of curbs.

E. Snow Guards
1. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing; complete with predrilled holes, clamps, or hooks for anchoring.
2. Surface-Mounted, Plastic, Stop-Type Snow Guards: Clear **OR** Integral-color, **as directed**, polycarbonate stops designed for attachment to panel surface of sheet metal roofing using construction adhesive, silicone or polyurethane sealant, or adhesive tape.
3. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to panel surface of sheet metal roofing using construction adhesive, silicone or polyurethane sealant, or adhesive tape.
4. Surface-Mounted, Copper, Stop-Type Snow Guards: Bronze-alloy stops designed for attachment to panel surface of copper roofing using solder.
5. Seam-Mounted, Stop-Type Snow Guards: Cast-aluminum **OR** Malleable-iron **OR** Clear polycarbonate **OR** Colored polycarbonate, **as directed**, stops designed for attachment to vertical ribs of standing-seam sheet metal roofing with stainless-steel set screws.

6. Seam-Mounted, Bar-Type Snow Guards: Rail- or fence-type assembly consisting of aluminum or stainless-steel rods, bars, or pipe held in place by stainless-steel clamps attached to vertical ribs of standing-seam sheet metal roofing.
   a. Aluminum Finish: Mill **OR** Clear anodized, **as directed**.
   b. Stainless-Steel Finish: Mill **OR** Enamel, **as directed**.

F. Fabrication
1. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
   a. Flat-Seam Roofing: Form flat-seam panels from metal sheets 20 by 28 inches (510 by 710 mm) with 1/2-inch (13-mm) notched and folded edges.
   b. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1 inch (25 mm) **OR** of 1-1/2 inches (38 mm) **OR** as indicated, **as directed**.
   c. Batten-Seam Roofing: Form batten-seam panels with sides turned up 2-1/8 inches (54 mm) **OR** as indicated, **as directed**, with 1/2-inch (13-mm) flange turned toward center of pan.
   d. Horizontal-Seam (Bermuda-Type) Roofing: Form horizontal-seam (Bermuda-type) panels with upper edges turned up and extending above batten 1/2 inch (13 mm).
2. General: Fabricate roll-formed sheet metal roofing panels with UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article. Fabricate roll-formed sheet metal according to equipment manufacturer's written instructions and to comply with details shown.
3. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
4. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
5. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.
   a. Lay out sheet metal roofing so transverse seams, if required, are made in direction of flow with higher panels overlapping lower panels.
   b. Offset transverse seams from each other 12 inches (300 mm) minimum.
   c. Fold and cleat eaves and transverse seams in the shop.
   d. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown on Drawings and as required for leakproof construction.
6. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
7. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.
8. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of the metals in contact.
9. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

a. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
b. Seams:
1) Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
OR
Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength, **as directed**.
c. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
e. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
10. Do not use graphite pencils to mark metal surfaces.

1.3 EXECUTION

A. Preparation
1. Lay out and nail battens to wood sheathing **OR** screw battens to wood sheathing **OR** screw battens to metal deck, **as directed**, before installation of sheet metal roofing.
a. Space fasteners not more than 18 inches (457 mm) o.c.
b. Space fasteners as required by portable roll-forming equipment manufacturer for specified UL classification for wind-uplift resistance.
2. Zinc-Tin Alloy-Coated Steel Roofing: For roofing with 3:12 slopes or less, paint underside of shop-coated, zinc-tin alloy-coated steel, before installation, with zinc-tin alloy-coated steel primer, applied at a dry film thickness of not less than 2.5 mils (0.06 mm). Comply with manufacturer's written instructions. This is in addition to the shop coating.

B. Underlayment Installation
1. Polyethylene Sheet: Install polyethylene sheet on roof sheathing under sheet metal roofing. Use adhesive for anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
2. Felt Underlayment: Install felt underlayment on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
a. Apply from eave to ridge.
OR
Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
3. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof **OR** at locations indicated, **as directed**, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
a. Roof perimeter for a distance up from eaves of 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**, beyond interior wall line.

b. Valleys, from lowest to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (150 mm).
c. Rake edges for a distance of 18 inches (460 mm).
d. Hips and ridges for a distance on each side of 12 inches (300 mm).
e. Roof to wall intersections for a distance from wall of 18 inches (460 mm).
f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).

4. Install flashings to cover underlayment to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
5. Apply slip sheet before installing sheet metal roofing.

C. Installation, General

1. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
   a. Field cutting of sheet metal roofing by torch is not permitted.
   b. Provide metal closures at peaks, rake edges, rake walls, eaves, and each side of ridge and hip caps, **as directed**.
   c. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
   d. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
   e. Install ridge **OR** ridge and hip, **as directed**, caps as sheet metal roofing work proceeds.
   f. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition. Install backing plates at roofing splices.
   g. Install sealant tape where indicated.
   h. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
   i. Do not use graphite pencils to mark metal surfaces.
2. Thermal Movement. Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.
   a. Point of Fixity: Fasten each panel along a single line of fixing located at eave **OR** ridge **OR** center of panel length **OR** locations indicated on Drawings, **as directed**.
   b. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
3. Fasteners: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws **OR** metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, **as directed**.
4. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by SMACNA.
   a. Coat back side of uncoated aluminum and stainless-steel sheet metal roofing with bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction.
5. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
6. Fasciae: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

D. Custom-Fabricated Sheet Metal Roofing Installation

1. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.
   a. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
   b. Fasten cleats not more than 12 inches (300 mm) o.c. Bend tabs over fastener head.
   c. Provide expansion-type cleats and clips for roof panels that exceed 30 feet (9.1 m) in length.
2. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
   a. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
   b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
3. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
   a. Do not solder metallic-coated steel **OR** aluminum **OR** titanium sheet.
   b. Do not pre-tin zinc-tin alloy-coated stainless steel **OR** zinc-tin alloy-coated copper.
   c. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
   d. Stainless-Steel Roofing: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
   e. Copper Roofing: Tin edges of uncoated copper sheets, using solder for copper.
4. Rivets: Rivet joints in uncoated aluminum **OR** zinc, **as directed**, where indicated and where necessary for strength.
5. Flat-Seam Roofing: Attach flat-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. After panels are in place, mallet seams and solder.
   a. Attach roofing panels with cleats spaced not more than 24 inches (610 mm) o.c.. Lock and solder panels to base flashing.
   b. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12 inches (305 mm) o.c. Lock panels to edge flashing and solder **OR** apply sealant, **as directed**.
6. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with cleats, double fastened at 12 inches (305 mm) o.c. Install panels reaching from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.
   a. Lock each panel to panel below with soldered **OR** sealed, **as directed**, transverse seam.
   b. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
      OR
      Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12 inches (305 mm) o.c. Lock panels to edge flashing.
   c. Leave seams upright **OR** Fold over seams, **as directed**, after locking at ridges and hips.
7. Batten-Seam Roofing: Attach batten-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. Hold cleats in place with battens and fold edges of cleats over to hold panels. After panels are in place and before batten cap is installed, apply continuous

bead of sealant to top of flanges of each panel. Install batten cap covering batten and panel edges and fold batten cap and panel together so batten cap and panel edges are completely engaged.

a. Hook each panel to panel below with soldered **OR** sealed, **as directed**, transverse seam.
b. Splay upturned edges of panels away from base of battens to provide expansion capability.
c. Close batten ends with metal closures. Fold together with panel edges and end of batten cap.
d. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
OR
Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12 inches (305 mm) o.c. Lock panels to edge flashing.

8. Horizontal-Seam (Bermuda-Type) Roofing: Attach horizontal-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. Attach cleats to battens, spaced at 8 inches (203 mm) o.c. Lock lower edge of each panel to upper edge of panel below, folding seam over to engage cleat and panel edges. After first fold, mallet seams against batten, leaving joint slightly angled to form drip.
   a. Hook end of each panel to adjacent panel with soldered **OR** sealed, **as directed**, cross seam.
   b. Hook panel at eave edge to continuous cleat.
   c. Join ridges and hips with a standing seam and leave seams upright **OR** fold over seams, **as directed**, after locking.
9. Field Painting: Paint exposed surfaces of zinc-tin alloy-coated steel with one coat of zinc-tin alloy-coated steel primer and one coat of zinc-tin alloy-coated steel finish coat as soon as possible after installation; apply each coat at a dry film thickness of not less than 2.5 mils (0.06 mm). Comply with manufacturer's written instructions.

E. On-Site, Roll-Formed Sheet Metal Roofing Installation
1. General: Install on-site, roll-formed sheet metal roofing fabricated from UL-certified equipment to comply with equipment manufacturer's written instructions for UL wind-uplift resistance class indicated. Provide sheet metal roofing of full length from eave to ridge unless otherwise restricted by on-site or shipping limitations.
2. Standing-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each standing-seam joint at location, at spacing, and with fasteners recommended by manufacturer of portable roll-forming equipment.
   a. Install clips to substrate with self-tapping fasteners.
   b. Install pressure plates at locations indicated in equipment manufacturer's written installation instructions.
   c. Before panels are joined, apply continuous bead of sealant to top of flange of lower panel.
   d. Snap-On Seam: Nest standing seams and fasten together by interlocking and completely engaging field-applied sealant.
   OR
   Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so cleat, sheet metal roofing, and field-applied sealant are completely engaged.
3. Batten-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each batten-seam joint at location, at spacing, and with fasteners recommended by manufacturer of portable roll-forming equipment.
   a. Install clips to substrate with self-drilling fasteners.
   b. After panels are in place and before batten cap is installed, apply continuous bead of sealant to top of flange of each panel.
   c. Apply snap-on batten caps to sheet metal roofing seams, fully engaged to provide weathertight joints.
4. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.

a. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

F. Accessory Installation
1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
a. Install components required for a complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
b. Install accessories integral to sheet metal roofing that are specified in Division 07 Section "Sheet Metal Flashing And Trim" to comply with that Section's requirements.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
a. Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
b. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
c. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
d. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, and filled with butyl sealant concealed within joints.
3. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.
4. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet sheet metal roofing.
5. Stop-Type Snow Guards: Attach snow guards to sheet metal roofing with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate sheet metal roofing.
a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning up from roof edge at gutter, with each snow guard centered between sheet metal roofing ribs, **as directed**.
6. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam sheet metal roofing with clamps or set screws. Do not use fasteners that will penetrate sheet metal roofing.
a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning up from roof edge at gutter.

G. Erection Tolerances
1. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

OR

Installation Tolerances: Shim and align sheet metal roofing within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

H. Cleaning And Protection
1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
2. Clean and neutralize flux materials. Clean off excess solder.
3. Clean off excess sealants.
4. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in a clean condition during construction.
5. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00a

Task	Specification	Specification Description
07 41 33 00	07 41 13 00	Metal Roof Panels
07 42 13 00	07 41 13 00	Metal Roof Panels

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SECTION 07 42 13 19 - GLAZING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for glazing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   a. Windows.
   b. Doors.
   c. Glazed curtain walls.
   d. Storefront framing.
   e. Glazed entrances.
   f. Sloped glazing.
   g. Skylights.
   h. Interior borrowed lites.

C. Definitions
1. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
2. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
3. Interspace: Space between lites of an insulating-glass unit.

D. Performance Requirements
1. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
2. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 **OR** ICC's 2003 International Building Code, **as directed**, by a qualified professional engineer, using the following design criteria:
   a. Design Wind Pressures: As indicated on Drawings.
   OR
   Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
      2) Importance Factor.
      3) Exposure Category: B **OR** C **OR** D, **as directed**.
   b. Design Snow Loads: As indicated on Drawings, **as directed**.
   c. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
   d. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
      1) Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
      2) Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.

3) Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.

e. Glass Type Factors for Wired, Patterned, and Sandblasted Glass:
1) Short-Duration Glass Type Factor for Wired Glass: 0.5.
2) Long-Duration Glass Type Factor for Wired Glass: 0.3.
3) Short-Duration Glass Type Factor for Patterned Glass: 1.0.
4) Long-Duration Glass Type Factor for Patterned Glass: 0.6.
5) Short-Duration Glass Type Factor for Sandblasted Glass: 0.5.

f. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.

g. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.

h. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.

i. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Preconstruction Testing

1. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

a. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

b. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.

d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

e. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

F. Submittals

1. Product Data: For each glass product and glazing material indicated.

2. LEED Submittals:

a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.

3. Glass Samples: For each type of glass product other than clear monolithic vision glass **OR** the following products, **as directed**; 12 inches (300 mm) square.

a. Tinted glass.
b. Patterned glass.
c. Coated glass.
d. Wired glass.
e. Fire-resistive glazing products.
f. Laminated glass with colored interlayer.
g. Insulating glass.

4. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, **as directed**.

5. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
6. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
7. Qualification Data: For installers, manufacturers of insulating-glass units with sputter-coated, low-e coatings, glass testing agency and sealant testing agency.
8. Product Certificates: For glass and glazing products, from manufacturer.
9. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, coated glass, insulating glass, glazing sealants and glazing gaskets.
    a. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
10. Preconstruction adhesion and compatibility test report.
11. Warranties: Sample of special warranties.

G. Quality Assurance
1. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified, **as directed**, by coated-glass manufacturer.
2. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
3. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
4. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
5. Source Limitations for Glass: Obtain ultraclear float glass, tinted float glass, coated float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.
6. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
7. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
    a. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
    b. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
    c. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
    d. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
8. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC **OR** the SGCC or another certification agency acceptable to authorities having jurisdiction **OR** the manufacturer, **as directed**. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
9. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.
10. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
11. Preinstallation Conference: Conduct conference at Project site.

H. Delivery, Storage, And Handling

1. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
2. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

I. Project Conditions
1. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

J. Warranty
1. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   a. Warranty Period: 10 years from date of Final Completion.
2. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
3. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   a. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

A. Glass Products, General
1. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
   a. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
   b. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
2. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article, **as directed**. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article, **as directed**. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
3. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic **OR** enhanced, **as directed**,-protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested according to ASTM E 1886. Test

specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

a. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
b. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.
OR
Large-Missile Test: For all glazing, regardless of height above grade.

4. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   a. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick **OR** of thickness indicated, **as directed**.
   b. For laminated-glass lites, properties are based on products of construction indicated.
   c. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   d. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   e. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   f. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

B. Glass Products
1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
2. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87, **as directed**.
3. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   b. For uncoated glass, comply with requirements for Condition A.
   c. For coated vision glass, comply with requirements for Condition C (other coated glass).
4. Pyrolytic-Coated, Self-Cleaning, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
5. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
   a. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
   b. Visible Light Transmittance: as directed by the Owner.
6. Polished Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6, complying with ANSI Z97.1, Class C.
   a. Mesh: M1 (diamond) **OR** M2 (square), **as directed**.
7. Film-Faced Polished Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6 and complying with testing requirements in 16 CFR 1201 for Category II materials.
   a. Mesh: M1 (diamond) **OR** M2 (square), **as directed**.
8. Patterned Glass: ASTM C 1036, Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F1 (patterned one side) **OR** Finish F2 (patterned both sides), **as directed**, Pattern P1 (linear) **OR** Pattern P2 (geometric) **OR** Pattern P3 (random) **OR** Pattern P4 (special), **as directed**.
9. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F1 (patterned one side) **OR** Finish F2 (patterned both sides), **as directed**, Pattern P1 (linear) **OR** Pattern P2 (geometric) **OR** Pattern P3 (random) **OR** Pattern P4 (special), **as directed**.
10. Patterned Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 2, Quality-Q6, Finish F1 (patterned one side) **OR** Finish F2 (patterned both sides), **as directed**, Mesh M1 (diamond), Pattern P1 (linear) **OR** Pattern P2 (geometric) **OR** Pattern P3 (random) **OR** Pattern P4 (special), **as directed**.

11. Ceramic-Coated Vision Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.
    a. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
    b. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
    c. Ceramic Coating Color and Pattern: As selected from manufacturer's full range.
12. Reflective-Coated Vision Glass: ASTM C 1376, coated by pyrolytic process **OR** vacuum deposition (sputter-coating) process, **as directed**, and complying with other requirements specified.
    a. Kind: Kind CV (coated vision glass), except that Kind CO (coated overhead glass) may be used where the lower edge of the glass is more than 6 feet (1.8 m) above the adjacent floor level or cannot be approached closer than 10 feet (3.0 m).
    b. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
    c. Glass: Clear float **OR** Tinted float, **as directed**.
    d. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
    e. Visible Light Transmittance:
    f. Outdoor Visible Reflectance: as directed by the Owner.
    g. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.
13. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
    a. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
    b. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
    c. Ceramic Coating Color: As selected from manufacturer's full range.
14. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.
    a. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
    b. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
    c. Silicone Coating Color: As selected from manufacturer's full range.
15. Reflective-Coated Spandrel Glass: ASTM C 1376, Kind CS; coated by pyrolytic process **OR** vacuum deposition (sputter-coating) process, **as directed**, and complying with other requirements specified.
    a. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
    b. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
    c. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
    d. Visible Light Transmittance: as directed by the Owner.
    e. Outdoor Visible Reflectance: as directed by the Owner.

C. Laminated Glass
1. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
    a. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
    b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
    c. Interlayer Color: Clear unless otherwise indicated.
2. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
    a. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:

1) Polyvinyl butyral interlayer.
2) Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
3) Ionoplast interlayer.
4) Cast-in-place and cured-transparent-resin interlayer.
5) Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
c. Interlayer Color: Clear unless otherwise indicated.

3. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

D. Insulating Glass
1. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
a. Sealing System: Dual seal, with manufacturer's standard **OR** polyisobutylene and polysulfide **OR** polyisobutylene and silicone **OR** polyisobutylene and hot-melt butyl **OR** polyisobutylene and polyurethane, **as directed**, primary and secondary.
b. Spacer: Manufacturer's standard spacer material and construction **OR** Aluminum with mill or clear anodic finish **OR** Aluminum with black, color anodic finish **OR** Aluminum with bronze, color anodic finish **OR** Aluminum with powdered metal paint finish in color selected **OR** Galvanized steel **OR** Stainless steel **OR** Polypropylene covered stainless steel in color selected **OR** Thermally broken aluminum **OR** Nonmetallic laminate **OR** Nonmetallic tube, **as directed**.
c. Desiccant: Molecular sieve or silica gel, or blend of both.
2. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article, **as directed**, as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article, **as directed**.

E. Fire-Protection-Rated Glazing
1. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
2. Monolithic Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness.
3. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials.
4. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch (8-mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
5. Fire-Protection-Rated Tempered Glass: 1/4-inch- (6.4-mm-) **OR** 3/8-inch- (9.5-mm-) **OR** 1/2-inch- (12.7-mm-), **as directed**, thick, fire-protection-rated tempered glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
6. Fire-Protection-Rated Laminated Glass: 5/16-inch- (8-mm-) thick, fire-protection-rated laminated glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
7. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.
8. Gel-Filled, Double Glazing Units: Double glazing units made from two lites of uncoated, clear, fully tempered float glass; with a perimeter metal spacer separating lites and dual-edge seal enclosing a cavity filled with clear, fully transparent, heat-absorbing gel; complying with testing requirements in 16 CFR 1201 for Category II materials.

F. Glazing Gaskets

1. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   a. Neoprene complying with ASTM C 864.
   b. EPDM complying with ASTM C 864.
   c. Silicone complying with ASTM C 1115.
   d. Thermoplastic polyolefin rubber complying with ASTM C 1115.
2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   a. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
3. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

G. Glazing Sealants
1. General:
   a. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   b. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   c. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
   d. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
3. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
4. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
5. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
6. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

H. Glazing Tapes
1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   a. AAMA 804.3 tape, where indicated.
   b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

I. Miscellaneous Glazing Materials
1. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
3. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
4. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
5. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
6. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
7. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

J. Fabrication Of Glazing Units
1. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
2. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
3. Grind smooth and polish exposed glass edges and corners.

K. Monolithic-Glass Types
1. Glass Type: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Provide safety glazing labeling.
2. Glass Type: Ultraclear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Provide safety glazing labeling.
3. Glass Type: Pyrolytic-coated, self-cleaning, low-maintenance, clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Provide safety glazing labeling.
4. Glass Type: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Winter Nighttime U-Factor: as directed by the Owner.
   c. Summer Daytime U-Factor: as directed by the Owner.
   d. Solar Heat Gain Coefficient: as directed by the Owner.
   e. Provide safety glazing labeling.
5. Glass Type: Polished wired glass.
   a. Thickness: 6.0 mm.
6. Glass Type: Patterned glass.
   a. Thickness: 4.0 **OR** 5.0 **OR** 6.0, **as directed**, mm.
7. Glass Type: Tempered patterned glass.
   a. Thickness: 4.0 **OR** 5.0 **OR** 6.0, **as directed**, mm.
   b. Provide safety glazing labeling.
8. Glass Type: Patterned wired glass.
   a. Thickness: 6.0 mm.

9. Glass Type: Ceramic-coated vision glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Coating Location: Second surface.
   c. Winter Nighttime U-Factor: as directed by the Owner.
   d. Summer Daytime U-Factor: as directed by the Owner.
   e. Solar Heat Gain Coefficient: as directed by the Owner.
   f. Provide safety glazing labeling.
10. Glass Type: Reflective-coated vision glass, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Coating Location: First **OR** Second, **as directed**, surface.
   c. Winter Nighttime U-Factor: as directed by the Owner.
   d. Summer Daytime U-Factor: as directed by the Owner.
   e. Solar Heat Gain Coefficient: as directed by the Owner.
   f. Provide safety glazing labeling.
11. Glass Type: Ceramic-coated spandrel glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Coating Location: Second surface.
   c. Winter Nighttime U-Factor: as directed by the Owner.
   d. Summer Daytime U-Factor: as directed by the Owner.
   e. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
12. Glass Type: Silicone-coated spandrel glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Coating Location: Second surface.
   c. Winter Nighttime U-Factor: as directed by the Owner.
   d. Summer Daytime U-Factor: as directed by the Owner.
   e. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
13. Glass Type: Reflective-coated spandrel glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness: 6.0 mm.
   b. Coating Location: First **OR** Second, **as directed**, surface.
   c. Winter Nighttime U-Factor: as directed by the Owner.
   d. Summer Daytime U-Factor: as directed by the Owner.
   e. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
   f. Factory apply manufacturer's standard opacifier of the following material to coated second surface of lites, with resulting products complying with Specification No. 89-1-6 in GANA's Tempering Division's "Engineering Standards Manual":
      1) Manufacturer's standard opacifier material.
         OR
         Polyester film laminated to glass with solvent-based adhesive.

L. Laminated-Glass Types
1. Glass Type: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** ultraclear float glass **OR** ultraclear heat-strengthened float glass **OR** ultraclear fully tempered float glass, **as directed**.
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.

c. Provide safety glazing labeling.

2. Glass Type: Antireflective-coated clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** ultraclear float glass **OR** ultraclear heat-strengthened float glass **OR** ultraclear fully tempered float glass, **as directed**.
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   c. Visible Reflectance: Less than 2 percent.
   d. Winter Nighttime U-Factor: as directed by the Owner.
   e. Summer Daytime U-Factor: as directed by the Owner.
   f.
   g. Solar Heat Gain Coefficient: as directed by the Owner.
   h.
   i. Provide safety glazing labeling.
3. Glass Type: Tinted laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**, with outer ply Class 2 (tinted) and inner ply Class 1 (clear).
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   c. Winter Nighttime U-Factor: as directed by the Owner.
   d.
   e. Summer Daytime U-Factor: as directed by the Owner.
   f.
   g. Solar Heat Gain Coefficient: as directed by the Owner.
   h.
   i. Provide safety glazing labeling.
4. Glass Type: Tinted laminated glass with two plies of clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**, and tinted interlayer.
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   c. Interlayer Color: Blue-green **OR** Bronze light **OR** Gray, **as directed**.
   d. Winter Nighttime U-Factor: as directed by the Owner.
   e.
   f. Summer Daytime U-Factor: as directed by the Owner.
   g.
   h. Solar Heat Gain Coefficient: as directed by the Owner.
   i. Provide safety glazing labeling.
5. Glass Type: Ceramic-coated, laminated vision glass with two plies of heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   c. Coating Location: Second **OR** Third **OR** Fourth, **as directed**, surface.
   d. Winter Nighttime U-Factor: as directed by the Owner.
   e.
   f. Summer Daytime U-Factor: as directed by the Owner.
   g.
   h. Solar Heat Gain Coefficient: as directed by the Owner.
   i.
   j. Provide safety glazing labeling.

6. Glass Type: Reflective-coated, laminated vision glass with two plies of heat-strengthened float glass **OR** fully tempered float glass, **as directed**, with inner ply Class 1 (clear).
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   c. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
   d. Winter Nighttime U-Factor: as directed by the Owner.
   e.
   f. Summer Daytime U-Factor: as directed by the Owner.
   g.
   h. Solar Heat Gain Coefficient: as directed by the Owner.
   i. Provide safety glazing labeling.
7. Glass Type: Low-e-coated, laminated vision glass with two plies of clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directedf**.
   c. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
   d. Visible Light Transmittance: as directed by the Owner.
   e.
   f. Winter Nighttime U-Factor: as directed by the Owner.
   g.
   h. Summer Daytime U-Factor: as directed by the Owner.
   i.
   j. Solar Heat Gain Coefficient: as directed by the Owner.
   k.
   l. Provide safety glazing labeling.
8. Glass Type: Reflective-coated, laminated spandrel glass with two plies of heat-strengthened float glass **OR** fully tempered float glass, **as directed**, with inner ply Class 1 (clear).
   a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   c. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
   d. Winter Nighttime U-Factor: as directed by the Owner.
   e.
   f. Summer Daytime U-Factor: as directed by the Owner.
   g.

M. Insulating-Glass Types
1. Glass Type: Clear insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
   b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
   f. Winter Nighttime U-Factor: as directed by the Owner.
   g.
   h. Summer Daytime U-Factor: as directed by the Owner.
   i. Provide safety glazing labeling.

2. Glass Type: Ultraclear insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
   b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Ultraclear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Ultraclear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   f. Winter Nighttime U-Factor: as directed by the Owner.
   g.
   h. Summer Daytime U-Factor: as directed by the Owner.
   i.
   j. Provide safety glazing labeling.
3. Glass Type: Pyrolytic-coated, self-cleaning, low-maintenance, clear insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
   b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Pyrolytic-coated, self-cleaning, low-maintenance, clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
   f. Winter Nighttime U-Factor: as directed by the Owner.
   g. Summer Daytime U-Factor: as directed by the Owner.
   h. Provide safety glazing labeling.
4. Glass Type: Low-e-coated, clear insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
   b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
   f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
   g. Visible Light Transmittance: as directed by the Owner.
   h. Winter Nighttime U-Factor: as directed by the Owner.
   i. Summer Daytime U-Factor: as directed by the Owner.
   j. Solar Heat Gain Coefficient: as directed by the Owner.
   k. Provide safety glazing labeling.
5. Glass Type: Tinted insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
   b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   f. Winter Nighttime U-Factor: as directed by the Owner.
   g. Summer Daytime U-Factor: as directed by the Owner.
   h. Solar Heat Gain Coefficient: as directed by the Owner.
   i. Provide safety glazing labeling.
6. Glass Type: Low-e-coated, tinted insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
   b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.

c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
g. Visible Light Transmittance: as directed by the Owner.
h. Winter Nighttime U-Factor: as directed by the Owner.
i. Summer Daytime U-Factor: as directed by the Owner.
j. Solar Heat Gain Coefficient: as directed by the Owner.
k. Provide safety glazing labeling.

7. Glass Type: Ceramic-coated, insulating vision glass.
a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
c. Outdoor Lite: Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
f. Coating Location: Second **OR** Third **OR** Fourth, **as directed**, surface.
g. Winter Nighttime U-Factor: as directed by the Owner.
h. Summer Daytime U-Factor: as directed by the Owner.
i. Solar Heat Gain Coefficient: as directed by the Owner.
j. Provide safety glazing labeling.

8. Glass Type: Reflective-coated, clear insulating glass.
a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
c. Outdoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
g. Winter Nighttime U-Factor: as directed by the Owner.
h. Summer Daytime U-Factor: as directed by the Owner.
i. Solar Heat Gain Coefficient: as directed by the Owner.
j. Provide safety glazing labeling.

9. Glass Type: Reflective-coated, tinted insulating glass.
a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
g. Winter Nighttime U-Factor: as directed by the Owner.
h. Summer Daytime U-Factor: as directed by the Owner.
i. Solar Heat Gain Coefficient: as directed by the Owner.
j. Provide safety glazing labeling.

10. Glass Type: Ceramic-coated **OR** Silicone-coated, **as directed**, insulating spandrel glass.
a. Overall Unit Thickness: 1 inch (25 mm).
b. Thickness of Each Glass Lite: 5.0 mm **OR** 6.0 mm, **as directed**.

c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
f. Coating Location: Fourth surface.
g. Winter Nighttime U-Factor: as directed by the Owner.
h. Summer Daytime U-Factor: as directed by the Owner.

11. Glass Type: Ceramic-coated **OR** Silicone-coated, **as directed**, low-e, insulating spandrel glass.
a. Overall Unit Thickness: 1 inch (25 mm).
b. Thickness of Each Glass Lite: 5.0 mm **OR** 6.0 mm, **as directed**.
c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
g. Opaque Coating Location: Fourth surface.
h. Winter Nighttime U-Factor: as directed by the Owner.
i. Summer Daytime U-Factor: as directed by the Owner.

12. Glass Type: Ceramic-coated **OR** Silicone-coated, **as directed**, tinted, insulating spandrel glass.
a. Overall Unit Thickness: 1 inch (25 mm).
b. Thickness of Each Glass Lite: 5.0 mm **OR** 6.0 mm.
c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
f. Coating Location: Fourth surface.
g. Winter Nighttime U-Factor: as directed by the Owner.
h. Summer Daytime U-Factor: as directed by the Owner.

N. Insulating-Laminated-Glass Types
1. Glass Type: Clear insulating laminated glass.
a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
c. Outdoor Lite: Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
f. Winter Nighttime U-Factor: as directed by the Owner.
g. Summer Daytime U-Factor: as directed by the Owner.
h. Solar Heat Gain Coefficient: as directed by the Owner.
i. Provide safety glazing labeling.

2. Glass Type: Low-e-coated, clear insulating laminated glass.

a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
c. Outdoor Lite: Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
d. Interspace Content: Air **OR** Argon, **as directed**.
e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
   2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
g. Visible Light Transmittance: as directed by the Owner.
h. Winter Nighttime U-Factor: as directed by the Owner.
i. Summer Daytime U-Factor: as directed by the Owner.
j. Solar Heat Gain Coefficient: as directed by the Owner.
k. Provide safety glazing labeling.

3. Glass Type: Tinted, insulating laminated glass.
   a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
   b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Tinted heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
      1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
      2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   f. Winter Nighttime U-Factor: as directed by the Owner.
   g. Summer Daytime U-Factor: as directed by the Owner.
   h. Solar Heat Gain Coefficient: as directed by the Owner.
   i. Provide safety glazing labeling.

4. Glass Type: Low-e-coated, tinted, insulating laminated glass.
   a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
   b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
   c. Outdoor Lite: Tinted heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
      1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
      2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
   g. Visible Light Transmittance: as directed by the Owner.
   h. Winter Nighttime U-Factor: as directed by the Owner.
   i. Summer Daytime U-Factor: as directed by the Owner.
   j. Solar Heat Gain Coefficient: as directed by the Owner.
   k. Provide safety glazing labeling.

5. Glass Type: Reflective-coated, clear, insulating laminated glass.
   a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm), **as directed**.
   b. Thickness of Outdoor Lite: 6.0 mm.
   c. Outdoor Lite: Clear heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
      1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
      2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
   f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
   g. Winter Nighttime U-Factor: as directed by the Owner.
   h. Summer Daytime U-Factor: as directed by the Owner.
   i. Solar Heat Gain Coefficient: as directed by the Owner.
   j. Provide safety glazing labeling.
6. Glass Type: Reflective-coated, tinted, insulating laminated glass.
   a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm), **as directed**.
   b. Thickness of Outdoor Lite: 6.0 mm.
   c. Outdoor Lite: Tinted heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
   d. Interspace Content: Air **OR** Argon, **as directed**.
   e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
      1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
      2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **asdrected**.
   f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
   g. Winter Nighttime U-Factor: as directed by the Owner.
   h. Summer Daytime U-Factor: as directed by the Owner.
   i. Solar Heat Gain Coefficient: as directed by the Owner.
   j. Provide safety glazing labeling.

O. Fire-Protection-Rated Glazing Types
1. Glass Type: 20-minute fire-rated glazing without hose-stream test; monolithic ceramic glazing **OR** film-faced ceramic glazing **OR** laminated ceramic glazing **OR** fire-protection-rated tempered glass **OR** fire-protection-rated laminated glass **OR** gel-filled, double glazing units, **as directed**.
   a. Provide safety glazing labeling.
2. Glass Type: 20-minute fire-rated glazing with hose-stream test; monolithic ceramic glazing **OR** film-faced ceramic glazing **OR** laminated ceramic glazing **OR** gel-filled, double glazing units, **as directd**.
   a. Provide safety glazing labeling.
3. Glass Type: 45-minute **OR** 60-minute **OR** 90-minute **OR** 120-minute, **as directed**, fire-rated glazing; monolithic ceramic glazing **OR** film-faced ceramic glazing **OR** laminated ceramic glazing **OR** laminated glass with intumescent interlayers **OR** gel-filled, double glazing units, **as directed**.
   a. Provide safety glazing labeling.
4. Glass Type: 45-minute **OR** 60-minute **OR** 90-minute **OR** 120-minute, **as directed**, fire-rated glazing with 450 deg F (250 deg C) temperature rise limitation; laminated glass with intumescent interlayers **OR** gel-filled, double glazing units, **as directed**.
   a. Provide safety glazing labeling.

1.3 EXECUTION

A. Examination
1. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   a. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   b. Presence and functioning of weep systems.
   c. Minimum required face and edge clearances.
   d. Effective sealing between joints of glass-framing members.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
2. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

C. Glazing, General
1. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
2. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
3. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
4. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
5. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
6. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
7. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   a. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   b. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
8. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
9. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
10. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
11. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
12. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

D. Tape Glazing
1. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
2. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
3. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
4. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
5. Do not remove release paper from tape until right before each glazing unit is installed.
6. Apply heel bead of elastomeric sealant.
7. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
8. Apply cap bead of elastomeric sealant over exposed edge of tape.

E. Gasket Glazing (Dry)
1. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
2. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
3. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
4. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
5. Install gaskets so they protrude past face of glazing stops.

F. Sealant Glazing (Wet)
1. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
3. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

G. Lock-Strip Gasket Glazing
1. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

H. Cleaning And Protection
1. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
2. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

3. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
4. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
5. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 07 42 13 19

Task	Specification	Specification Description
07 42 63 00	01 22 16 00	No Specification Required

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SECTION 07 42 93 00 - SIDING

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Aluminum, Fiber-cement, and Vinyl siding.
b. Aluminum, Fiber-cement, and Vinyl soffit.

C. Submittals
1. Product Data: For each type of product indicated.
a. For vinyl siding, include VSI's official certification logo printed on product data.
2. Samples: For siding and soffit including related accessories.
3. Qualification Data: For qualified vinyl siding Installer.
4. Product certificates.
5. Product test reports.
6. Research/evaluation reports
7. Maintenance data.
8. Warranty: Sample of special warranty.

D. Quality Assurance
1. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
2. Vinyl Siding Installer Qualifications: A qualified installer who employs a VSI-Certified Installer on Project.
3. Vinyl Siding Certification Program: Provide vinyl siding products that are listed in VSI's list of certified products.
4. Source Limitations: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, from single source from single manufacturer.
5. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Store materials in a dry, well-ventilated, weathertight place.

F. Warranty
1. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and/or soffit that fail(s) in materials or workmanship within 10 **OR** 25 **OR** 50, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Siding
1. General: Formed and coated aluminum siding complying with AAMA 1402.
2. Horizontal Pattern: 8-inch (203-mm) exposure in plain, single-board **OR** beaded-edge, single-board **OR** plain, double-board, 4-inch (102-mm), **as directed**, style.
3. Horizontal Pattern: 10-inch (254-mm) exposure in plain, **OR** Dutch-lap, **as directed**, double, 5-inch (127-mm) board style.

4. Vertical Pattern: 12-inch (300-mm) exposure in board-and-batten, single-board style.
5. Vertical Pattern: 16-inch (400-mm) exposure in V-grooved, triple, 5-1/3-inch (135-mm) board style.
6. Texture: Smooth **OR** Wood grain, **as directed**.
7. Nominal Thickness: 0.019 inch (0.5 mm) **OR** 0.024 inch (0.6 mm), **as directed**.
8. Insulation: Manufacturer's standard integral insulation panels.
9. Finish: Manufacturer's standard three-coat PVDF **OR** primer and baked-on acrylic **OR** primer and baked-on polyester, **as directed**.
    a. Colors: As selected by the Owner from manufacturer's full range of industry colors.

B. Fiber-Cement Siding
1. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
    a. Horizontal Pattern: Boards 5-1/4 inches (133 mm) **OR** 6-1/4 to 6-1/2 inches (159 to 165 mm) **OR** 7-1/4 to 7-1/2 inches (184 to 190 mm) **OR** 8-1/4 to 8-1/2 inches (210 to 216 mm) **OR** 9-1/4 to 9-1/2 inches (235 to 241 mm), **as directed**, wide in plain **OR** beaded-edge, **as directed**, style.
        1) Texture: Smooth **OR** Rough sawn **OR** Wood grain, **as directed**.
    b. Vertical Pattern: 48-inch- (1200-mm-) wide sheets with wood-grain texture and grooves 8 inches (203 mm) **OR** 12 inches (300 mm), **as directed**, o.c.
    c. Shingle Pattern: 48-inch- (1200-mm-) wide, straight-edge notched **OR** staggered-edge notched, **as directed**, sheets with wood-grain texture.
    d. Panel Texture: 48-inch- (1200-mm-) wide sheets with smooth **OR** stucco **OR** wood-grain, **as directed**, texture.
    e. Factory Priming: Manufacturer's standard acrylic primer.

C. Vinyl Siding
1. General: Integrally colored vinyl siding complying with ASTM D 3679.
2. Horizontal Pattern: 6-1/2- or 7-inch (165- or 178-mm) exposure in beaded-edge, single-board style.
3. Horizontal Pattern: 8-inch (203-mm) exposure in plain, single-board **OR** double board, 4-inch (102-mm) **OR** triple board, 2-2/3-inch (68-mm), **as directed**, style.
4. Horizontal Pattern: 8-inch (203-mm) exposure in Dutch-lap, double, 4-inch (102-mm) board style.
5. Horizontal Pattern: 9-inch (229-mm) exposure in plain, double board, 4-1/2-inch (114-mm) **OR** triple board, 3-inch (76-mm), **as directed**, style.
6. Horizontal Pattern: 9-inch (229-mm) exposure in Dutch-lap, double, 4-1/2-inch (114-mm) board style.
7. Horizontal Pattern: 10-inch (254-mm) exposure in plain, **OR** Dutch-lap, **as directed**, double, 5-inch (127-mm) board style.
8. Vertical Pattern: 6-inch (152-mm) exposure in V-grooved, single-board style.
9. Vertical Pattern: 8-inch (203-mm) exposure in beaded-edge, double, 4-inch (102-mm) board style.
10. Vertical Pattern: 10-inch (254-mm) exposure in V-grooved, double, 5-inch (127-mm) board style.
11. Vertical Pattern: 12-inch (300-mm) exposure in V-grooved, double board, 6-inch (152-mm) **OR** triple board, 4-inch (102-mm), **as directed**, style.
12. Shingle Pattern: 48-inch- (1200-mm-) wide, straight-edge notched **OR** staggered-edge notched **OR** half-round edge **OR** octagon edge, **as directed**, sheets with wood-grain texture.
13. Texture: Smooth **OR** Wood grain, **as directed**.
14. Nominal Thickness: 0.040 inch (1.0 mm) **OR** 0.044 inch (1.1 mm), **as directed**.
15. Minimum Profile Depth (Butt Thickness): 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
16. Nailing Hem: Double thickness.
17. Finish: Wood-grain print with clear protective coating containing not less than 70 percent PVDF.
    a. Colors: As selected by the Owner from manufacturer's full range of industry colors.

D. Aluminum Soffit
1. General: Formed and coated aluminum soffit complying with AAMA 1402.
2. Pattern: 6-inch (152-mm) exposure in V-grooved, single-board style.
3. Pattern: 10-inch (254-mm) exposure in V-grooved, double, 5-inch (127-mm) board style.
4. Pattern: 12-inch (300-mm) exposure in V-grooved, double, 6-inch (152-mm) board style.
5. Pattern: 16-inch (400-mm) exposure in V-grooved, triple board, 5-1/3-inch (135-mm) **OR** quadruple board, 4-inch (102-mm), **as directed**, style.
6. Texture: Smooth **OR** Wood grain, **as directed**.
7. Ventilation: Provide perforated **OR** unperforated, **as directed**, soffit unless otherwise indicated.
8. Nominal Thickness: 0.019 inch (0.5 mm) **OR** 0.024 inch (0.6 mm), **as directed**.
9. Finish: Manufacturer's standard three-coat PVDF **OR** primer and baked-on acrylic **OR** primer and baked-on polyester, **as directed**.
   a. Colors: As selected by the Owner from manufacturer's full range of industry colors **OR** Match adjacent siding, **as directed**.

E. Fiber-Cement Soffit
1. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
2. Pattern: 12-inch- (300-mm-) **OR** 16-inch- (400-mm-) **OR** 24-inch- (600-mm-), **as directed**, wide sheets with smooth **OR** wood-grain, **as directed**, texture.
3. Ventilation: Provide perforated **OR** unperforated, **as directed**, soffit unless otherwise indicated.
4. Factory Priming: Manufacturer's standard acrylic primer.

F. Vinyl Soffit
1. General: Integrally colored vinyl soffit complying with ASTM D 4477.
2. Pattern: 6-inch (152-mm) exposure in V-grooved, single-board **OR** beaded-edge, triple board, 2-inch (51-mm), **as directed**, style.
3. Pattern: 8-inch (203-mm) exposure in V-grooved, double, 4-inch (102-mm) board style.
4. Pattern: 10-inch (254-mm) exposure in V-grooved, double, 5-inch (127-mm) board style.
5. Pattern: 12-inch (300-mm) exposure in V-grooved, double board, 6-inch (152-mm) **OR** triple board, 4-inch (102-mm), **as directed**, style.
6. Texture: Smooth **OR** Wood grain, **as directed**.
7. Ventilation: Provide perforated **OR** unperforated, **as directed**, soffit unless otherwise indicated.
8. Nominal Thickness: 0.035 inch (0.9 mm) **OR** 0.040 inch (1.0 mm) **OR** 0.044 inch (1.1 mm), **as directed**.
9. Minimum Profile Depth: 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
10. Colors: As selected by the Owner from manufacturer's full range of industry colors **OR** Match adjacent siding, **as directed**.

G. Accessories
1. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
   a. Provide accessories made from same material as **OR** matching color and texture of, **as directed**, adjacent siding unless otherwise indicated.
2. Aluminum Accessories: Where aluminum accessories are indicated, provide accessories complying with AAMA 1402.
   a. Texture: Smooth **OR** Wood grain, **as directed**.
   b. Nominal Thickness: 0.019 inch (0.5 mm) **OR** 0.024 inch (0.6 mm), **as directed**.
   c. Finish: Manufacturer's standard three-coat PVDF **OR** primer and baked-on acrylic **OR** primer and baked-on polyester, **as directed**.
3. Vinyl Accessories: Integrally colored vinyl accessories complying with ASTM D 3679 except for wind-load resistance.
   a. Texture: Smooth **OR** Wood grain, **as directed**.

4. Decorative Accessories: Provide the following aluminum **OR** fiber-cement **OR** vinyl, **as directed**, decorative accessories as indicated:
   a. Corner posts with fluted faces, **as directed**.
   b. Door and window casings with fluted faces, **as directed**, and corner rosettes, **as directed**.
   c. Entrance and window head pediments.
   d. Pilasters with fluted faces, **as directed**.
   e. Shutters with paneled **OR** louvered, **as directed**, faces.
   f. Louvers.
   g. Lattice.
   h. Fasciae.
   i. Moldings and trim.
5. Colors for Decorative Accessories: As selected by the Owner from manufacturer's full range of industry colors **OR** Match adjacent siding, **as directed**.
6. Flashing: Provide aluminum **OR** stainless-steel, **as directed**, flashing complying with Division 07 Section "Sheet Metal Flashing And Trim" at window and door heads and where indicated.
   a. Finish for Aluminum Flashing: Same as aluminum siding **OR** Siliconized polyester coating, same color as siding **OR** High-performance organic finish, same color as siding **OR** Factory-prime coating, **as directed**.
7. Fasteners:
   a. For fastening to wood, use siding nails **OR** ribbed bugle-head screws, **as directed**, of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
   b. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
   c. For fastening aluminum, use aluminum fasteners. Where fasteners will be exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
   d. For fastening fiber cement, use hot-dip galvanized **OR** stainless-steel, **as directed**, fasteners.
   e. For fastening vinyl, use aluminum **OR** hot-dip galvanized **OR** stainless-steel, **as directed**, fasteners. Where fasteners will be exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
8. Insect Screening for Soffit Vents: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh **OR** PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16 (1.4-by-1.8- or 1.4-by-1.6-mm) mesh **OR** Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, **as directed**.
9. Continuous Soffit Vents: Aluminum, hat-channel shape, with stamped louvers **OR** perforations, **as directed**; 2 inches (51 mm) wide and not less than 96 inches (2438 mm) long.
   a. Net-Free Area: 4 sq. in./linear ft. (280 sq. cm/m) **OR** 6 sq. in./linear ft. (420 sq. cm/m) **OR** 8 sq. in./linear ft. (560 sq. cm/m), **as directed**.
   b. Finish: Mill finish **OR** White paint **OR** Brown paint, **as directed**.
10. Round Soffit Vents: Stamped aluminum louvered vents, 2 inches (51 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm), **as directed**, in diameter, made to be inserted into round holes cut into soffit.
    a. Finish: Mill finish **OR** White paint **OR** Brown paint, **as directed**.

1.3 EXECUTION

A. Preparation
   1. Clean substrates of projections and substances detrimental to application.

B. Installation
   1. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
      a. Do not install damaged components.
      b. Center nails in elongated nailing slots without binding siding to allow for thermal movement.

2. Install aluminum siding and soffit and related accessories according to AAMA 1402.
   a. Install fasteners no more than 24 inches (600 mm) o.c.
3. Install fiber-cement siding and soffit and related accessories.
   a. Install fasteners no more than 24 inches (600 mm) o.c.
4. Install vinyl siding and soffit and related accessories according to ASTM D 4756.
   a. Install fasteners for horizontal vinyl siding no more than 16 inches (400 mm) o.c.
   b. Install fasteners for vertical vinyl siding no more than 12 inches (300 mm) o.c.
5. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.
6. Where aluminum siding will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

C. Adjusting And Cleaning
1. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
2. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 42 93 00

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SECTION 07 46 16 00 - METAL WALL PANELS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for metal wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Exposed-fastener, lap-seam metal wall panels.
b. Concealed-fastener, lap-seam metal wall panels.
c. Metal liner panels.
d. Metal soffit panels.

C. Definition
1. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements
1. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) (which is equivalent to a 50-mph (80-km/h) wind) and not more than 12 lbf/sq. ft. (575 Pa).
a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
a. Wind Loads: Determine loads based on the following minimum design wind pressures:
1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.

b. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.

7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
3. Samples: For each type of exposed finish required.
4. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items.
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
3. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
2. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.
5. Protect foam-plastic insulation as follows:
   a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
   c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   a. Warranty Period: Two years from date of Final Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   a. Finish Warranty Period:
      1) 20 years from date of Final Completion for fluoropolymer finish.
      2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials
1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
   c. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   d. Exposed Coil-Coated Finish:
      1) 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      2) 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3) 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      4) Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      5) Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      6) FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
      8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
   e. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   b. Exposed Coil-Coated Finish:
      1) 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      2) 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3) 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      4) Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      5) Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      6) FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
      8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
   c. Exposed Anodized Finish:
      1) Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
      2) Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
   d. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
   a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
      1) Natural finish.
      2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
         a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
      3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
         a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per

manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.

4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**, fully annealed.
   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      1) Run grain of directional finishes with long dimension of each piece.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
      3) Directional Satin Finish: No. 4.
   c. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
5. Panel Sealants:
   a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
   c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

B. Field-Installed Thermal Insulation
1. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (241 kPa), with maximum flame-spread index of 75 and smoke-developed index of 450.
2. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 1 or 2 **OR** Type II (asphalt felt or glass-fiber mat facing), Class 2 or 3, Grade 3, **as directed**, with maximum flame-spread index of 75 and smoke-developed index of 450, based on tests performed on unfaced core.
3. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m), with maximum flame-spread index of 75 and smoke-developed index of 450.
4. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (15 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**, with maximum flame-spread index of 75 and smoke-developed index of 450.
5. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread index of 25 and smoke-developed index of 50, and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).
6. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass **OR** slag or rock wool, **as directed**.
   a. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
   b. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
   c. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
7. Metal Building Insulation: ASTM C 991, Type I; or NAIMA 202 **OR** ASTM C 991, Type II, **as directed**, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
   a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:
      1) Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing **OR** Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating **OR** Polypropylene faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and polyester backing, **as directed**.

b. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed galvanized steel or PVC retainer clips colored to match insulation facing.

C. Miscellaneous Metal Framing
1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
   b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
   b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
   c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
   d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
7. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm), **as directed**.
8. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

D. Miscellaneous Materials
1. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

E. Exposed-Fastener, Lap-Seam Metal Wall Panels
1. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
2. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm)**, as directed,** thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 21.3 inches (541 mm) **OR** 29.3 inches (744 mm) **OR** 34.6 inches (881 mm) **OR** 37.3 inches (947 mm) **OR** 42.6 inches (1084 mm) **OR** 45.3 inches (1151 mm), **as directed**.

e. Panel Height: 0.5 inch (13 mm) **OR** 0.875 inch (22 mm), **as directed**.

3. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Major-Rib Spacing: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm), **as directed**, o.c.

e. Panel Coverage: 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.

f. Panel Height: 0.625 inch (16 mm) **OR** 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.

4. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced **OR** flat pan, **as directed**, between major valleys.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Major-Rib Spacing: 12 inches (305 mm) o.c.
d. Panel Coverage: 36 inches (914 mm).
e. Panel Height: 1.25 inches (32 mm).

5. Vee-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Rib Spacing: 5.3 inches (135 mm) **OR** 7.2 inches (183 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
e. Panel Coverage: 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**.
f. Panel Height: 1.375 inches (35 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.

6. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.
a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Rib Spacing: 2.67 inches (68 mm) **OR** 4.0 inches (102 mm) **OR** 5.3 inches (135 mm) **OR** 6.0 inches (152 mm), **as directed**, o.c.

e. Panel Coverage: 24 inches (610 mm) **OR** 28 inches (711 mm) **OR** 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm), **as directed**.

f. Panel Height: 0.625 inch (16 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.

7. Deep-Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.

a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Rib Spacing: 12 inches (305 mm) o.c.

e. Panel Coverage: 24 inches (610 mm).

f. Panel Height: 3.0 inches (76 mm) **OR** 4.0 inches (102 mm), **as directed**.

F. Concealed-Fastener, Lap-Seam Metal Wall Panels
1. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   d. Panel Coverage: 12 inches (305 mm), **as directed**.
   e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
3. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with narrow reveal joint between panels.
   a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE

fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 12 inches (305 mm).

e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.

4. Wide-Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and stepped profile between panel edges resulting in wide reveal joint between panels.

a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 12 inches (305 mm).

e. Panel Height: 1.5 inches (38 mm).

5. V-Groove-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges.

a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Panel Coverage: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm), **as directed**.

d. Panel Height: 0.625 inch (16 mm) **OR** 1.25 inches (32 mm), **as directed**.

6. Tapered-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.

a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.

d. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.

7. Curved-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, curved-side major ribs and flat pan between major ribs; with reveal joint between panels.

a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As indicated by manufacturer's designations **OR** Match samplesAs selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
   2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 12 inches (305 mm).

e. Panel Height: 0.875 inch (22 mm) **OR** 1.5 inches (38 mm), **as directed**.

8. Creased-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and center-creased pan between panel edges; with flush joint between panels.

a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 12 inches (305 mm).
e. Panel Height: 1.5 inches (38 mm).

9. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.
a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 12 inches (305 mm).
e. Panel Height: 0.875 inch (22 mm) **OR** 1.5 inches (38 mm), **as directed**.

G. Metal Liner Panels
1. General: Provide factory-formed metal liner panels designed for interior side of metal wall panel assemblies and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for a complete installation.
2. Flush-Profile Metal Liner Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.

2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.

e. Panel Height: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.

f. Acoustical Performance: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch- (3-mm-) diameter holes uniformly spaced approximately 1000 holes/sq. ft. (10 750 holes/sq. m).
1) NRC of not less than 0.65 **OR** 0.85 **OR** 1.00, **as directed**, when tested according to ASTM C 423.

H. Metal Soffit Panels
1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Metal Soffit Panels: Match profile and material of metal wall panels.
a. Finish: Match finish and color of metal wall panels **OR** As indicated on Drawings, **as directed**.
b. Sealant: Factory applied within interlocking joint.
3. Flush-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
a. Material: Same material, finish, and color as metal wall panels.
b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
c. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.

1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.

f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.

g. Panel Height: 0.875 inch (22 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 3.0 inches (76 mm), **as directed**.

h. Sealant: Factory applied within interlocking joint.

4. Reveal-Joint-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with recessed reveal joint between panels.

a. Material: Same material, finish, and color as metal wall panels.

b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

e. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.

f. Panel Height: 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.

5. V-Groove-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with V-groove joint between panels.
   a. Material: Same material, finish, and color as metal wall panels.
   b. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   d. Material: Aluminum sheet, 0.024 inch (0.65 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
      1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**
      2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   e. Panel Coverage: 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.
   f. Panel Height: 0.375 inch (10 mm) **OR** 0.44 inch (11 mm) **OR** 0.50 inch (13 mm) **OR** 0.625 inch (16 mm), **as directed**.

I. Accessories
1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
   a. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
   b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

J. Fabrication
1. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
5. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
      1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

K. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation
1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
   a. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

B. Thermal Insulation Installation
1. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 07 Section "Thermal Insulation".

a. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.
b. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.

2. Blanket Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:
a. Set vapor-retarder-faced insulation with vapor-retarder facing building exterior **OR** building interior **OR** as indicated on Drawings, **as directed**. Do not obstruct ventilation spaces, except for firestopping.
b. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
c. Install insulation straight and true in one-piece lengths. Comply with the following installation method:
1) Over-Framing Installation: Extend insulation over and perpendicular to top flange of framing members.
d. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with framing to hold insulation in place.

C. Metal Wall Panel Installation
1. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
a. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m.) in presence of factory-authorized representative.
b. Shim or otherwise plumb substrates receiving metal wall panels.
c. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
d. Install screw fasteners in predrilled holes.
e. Locate and space fastenings in uniform vertical and horizontal alignment.
f. Install flashing and trim as metal wall panel work proceeds.
g. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
h. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
i. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
j. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
a. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
c. Copper Wall Panels: Use copper, stainless-steel or hardware-bronze fasteners.
d. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

5. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   a. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   b. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
   c. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   d. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   e. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
   f. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
   g. At panel splices, nest panels with minimum ~~6-inch~~ (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
6. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.
7. Metal Liner Panels: Install panels on exterior side of girts with girts exposed to the interior **OR** interior side of girts with flush appearance on the inside **OR** girts as indicated on Drawings, **as directed**.
8. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install substrate board as indicated in Division 06 Section "Sheathing", in number of layers required for fire rating, over subgirts, attached with board fasteners. Install second set of subgirts horizontally, fastened through substrate board into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.
   a. Comply with UL **OR** FMG, **as directed**, requirements for fire-rated construction.

D. Metal Soffit Panel Installation
1. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.
2. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
   a. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

E. Accessory Installation
1. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   a. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form

hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

F. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports, **as directed by the Owner**.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
5. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Cleaning And Protection

1. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
2. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 16 00

SECTION 07 46 16 00a - METAL PLATE WALL PANELS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for metal plate wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes metal plate wall panels.

C. Definition
1. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements
1. General Performance: Metal plate wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal plate wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
   a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind.
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
   a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) {which is equivalent to a 50-mph (80-km/h) wind} and not more than 12 lbf/sq. ft. (575 Pa).
   a. Water Leakage: As defined according to AAMA 501.1.
   OR
   Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Provide metal plate wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   a. Wind Loads: Determine loads based on the following minimum design wind pressures:
      1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
      OR
      Uniform pressure as indicated on Drawings.
   b. Deflection Limits: Metal plate wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.

7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation layouts of metal plate wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
3. Samples: For each type of exposed finish required.
4. Delegated-Design Submittal: For metal plate wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Exterior elevations, drawn to scale and coordinating penetrations and wall-mounted items.
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
3. Fire-Resistance Ratings: Where indicated, provide metal plate wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver components, metal plate wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
2. Unload, store, and erect metal plate wall panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal plate wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal plate wall panel for period of installation.
5. Protect foam-plastic insulation as follows:
   a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
   c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal plate wall panel assemblies that fail in materials or workmanship within specified warranty period.
   a. Warranty Period: Two years from date of Final Completion.

2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal plate wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   a. Finish Warranty Period:
      1) 20 years from date of Final Completion for fluoropolymer finish.
      2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials
1. Aluminum Plate: ASTM B 209 (ASTM B 209M). Alloy and temper as recommended by manufacturer for application.
2. Copper Plate: ASTM B 152/B 152M, solid copper alloy.
3. Panel Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal plate wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

B. Miscellaneous Metal Framing
1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
   b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
   b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
   c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
   d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
7. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

C. Miscellaneous Materials
1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.
2. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

D. Metal Plate Wall Panels
1. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment system components, panel stiffeners, and accessories required for weathertight system.

a. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.120 inch (3.05 mm) **OR** 0.125 inch (3.18 mm) **OR** 0.1875 inch (4.76 mm) **OR** 0.190 inch (4.82 mm), **as directed**, thick.
b. Panel Depth: 2 inches (51 mm) **OR** As indicated on Drawings, **as directed**.
c. Exterior Finish: Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Four-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Clear anodized **OR** Color anodized, **as directed**.
1) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

2. Attachment System Components: Formed from extruded aluminum.
a. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.
b. Include manufacturer's standard subgirts, perimeter extrusions, tracks, and drainage channels, panel stiffeners, panel clips and anchor channels, **as applicable**.
c. Alignment Pins: Stainless steel.

E. Accessories
1. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
2. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.030 inch (0.76 mm) thick unless otherwise indicated.

F. Fabrication
1. General: Fabricate and finish metal plate wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal plate wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Metal Plate Wall Panels: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
a. Length and Width: Plus or minus 0.032 inch (0.81 mm) up to 48 inches (1219 mm); 0.064 inch (1.63 mm) more than 48 inches (1219 mm).
b. Diagonal: Plus or minus 0.1875 inch (4.76 mm).
c. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch (4.76 mm) maximum.
d. Thickness: Plus or minus 0.008 inch (0.2 mm).
e. Squareness: 0.1875-inch (4.76-mm) difference between diagonal measurements.
f. Camber: 0.032 inch (0.81 mm).
4. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal plate wall panel manufacturer.
1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal plate wall panel manufacturer for application, but not less than thickness of metal being secured.

G. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes
1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Four-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Mica Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. Metallic Fluoropolymer: AAMA 2605. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. FEVE Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
8. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
9. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

I. Copper-Alloy Finishes
1. Exposed Finish: Mill.
2. Exposed Finish: Finish designations prefixed by CDA comply with the system established by the Copper Development Association for designating copper-alloy finish systems.
a. Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):

1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

b. Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):

1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

1.3 EXECUTION

A. Preparation

1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous metal plate wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

B. Metal Plate Wall Panel Installation

1. General: Install metal plate wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   a. Commence metal plate wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m) in presence of factory-authorized representative.
   b. Shim or otherwise plumb substrates receiving metal plate wall panels.
   c. Flash and seal metal plate wall panels with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
   d. Install flashing and trim as metal plate wall panel work proceeds.
   e. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
   f. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
   a. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
   b. Copper Plate Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal plate wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall plate panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
   a. Seal metal plate wall panel end laps with double beads of sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
   b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
5. Attachment System, General: Install attachment system required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   a. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
6. Flange-Attachment Installation: Attach metal plate wall panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.

a. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
b. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.

7. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach flanges of metal plate wall panels to panel clips with fasteners **OR** by welding, **as directed**, as recommended by manufacturer.
   a. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
   b. Seal horizontal and vertical joints between adjacent metal plate wall panels with manufacturer's standard gaskets.
8. Subgirt-and-Spline Installation: Provide manufacturer's standard subgirts and splines that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
   a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
   b. Do not apply sealants to joints unless otherwise indicated on Drawings.
9. Track-Support Installation: Provide manufacturer's standard horizontal tracks and vertical tracks **OR** drain channels, **as directed**, that provide support and complete secondary drainage system, draining to the exterior at horizontal joints through drain tube. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
   a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
   b. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
10. Rail-Support Installation: Provide manufacturer's standard interlocking rails that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install rails at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by overlapping and interlocking support rails with perimeter rails attached to panels. Apply sealant, foam sealant, and tape sealant at locations recommended by manufacturer. Leave horizontal and vertical joints with open reveal.
    a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
    b. Install backer plates before installing support rails.
    c. Do not apply sealants to joints unless otherwise indicated on Drawings.
11. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by engaging horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
    a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
    b. Do not apply sealants to joints unless otherwise indicated on Drawings.

C. Accessory Installation

1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   a. Install components required for a complete metal plate wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Erection Tolerances
1. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

E. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal plate wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal plate wall panel installation, including accessories.
5. Metal plate wall panels will be considered defective if they do not pass tests and inspections.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
7. Prepare test and inspection reports.

F. Cleaning
1. Remove temporary protective coverings and strippable films, if any, as metal plate wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal plate wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
2. After metal plate wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal plate wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 16 00a

Task	Specification	Specification Description
07 46 16 00	07 41 13 00	Metal Roof Panels
07 46 16 00	07 42 93 00	Siding
07 46 19 00	07 41 13 00	Metal Roof Panels
07 46 19 00	07 46 16 00	Metal Wall Panels
07 46 19 00	07 46 16 00a	Metal Plate Wall Panels
07 46 19 00	07 42 93 00	Siding
07 46 23 00	06 10 00 00	Rough Carpentry
07 46 23 00	06 05 23 00a	Miscellaneous Carpentry
07 46 23 00	06 16 23 00	Sheathing
07 46 29 00	06 10 00 00	Rough Carpentry
07 46 29 00	06 05 23 00a	Miscellaneous Carpentry
07 46 29 00	06 16 23 00	Sheathing
07 46 33 00	07 42 93 00	Siding
07 46 46 00	01 22 16 00	No Specification Required
07 46 46 00	06 46 29 00	Exterior Architectural Woodwork
07 46 46 00	06 41 13 00	Interior Architectural Woodwork
07 46 46 00	07 42 93 00	Siding

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SECTION 07 46 63 00 - INSULATED-CORE METAL WALL PANELS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for insulated-core metal wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Foamed-insulation-core metal wall panels.
b. Laminated-insulation-core metal wall panels.
c. Honeycomb-core metal wall panels.

C. Definitions
1. Metal Wall Panel Assembly: Insulated-core metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements
1. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind.
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (299 Pa) and not more than 12 lbf/sq. ft. (575 Pa).
a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
a. Wind Loads: Determine loads based on the following minimum design wind pressures:
1) Uniform pressure of 20 lbf/sq. ft. (958 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.

b. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.

7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
8. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

E. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work.
3. Samples: For each type of exposed finish required.
4. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items.
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
   a. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
   b. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
   c. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
   d. Potential Heat: Acceptable level when tested according to NFPA 259.
   e. Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
3. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
2. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for

drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

4. Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   a. Warranty Period: Two years from date of Final Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   a. Finish Warranty Period:
      1) 20 years from date of Final Completion for fluoropolymer finish.
      2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
   c. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   d. Exposed Coil-Coated Finish:
      1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3) Four-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      4) Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      5) Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      6) FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.097 mm) for topcoat.

e. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
b. Exposed Coil-Coated Finishes:
1) Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2) Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3) Four-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4) Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5) Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6) FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.097 mm) for topcoat.
c. Exposed Anodized Finish:
1) Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2) Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
d. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
1) Natural finish.

2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
   a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
   a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.

4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**, fully annealed.
   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      1) Run grain of directional finishes with long dimension of each piece.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
      3) Directional Satin Finish: No. 4.
   c. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
5. Panel Sealants:
   a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
   c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

B. Insulation For Panel Cores
1. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place **OR** board, **as directed**, type, with maximum flame-spread index of 25 and smoke-developed index of 450.
   a. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density, unless otherwise indicated; with maximum flame-spread index of 25 and smoke-developed index of 450.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (14 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), Class 2 or 3, Grade 3, **as directed**, with maximum flame-spread index of 25 and smoke-developed index of 450.

C. Miscellaneous Metal Framing
1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:

a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
b. Depth: As indicated **OR** 7/8 inch (21 mm) **OR** 1-1/2 inches (38 mm), **as directed**.

6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
   a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
   b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
   c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
7. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.52-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
8. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

D. Miscellaneous Materials
1. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
2. Backer Board: Hardboard complying with AHA A135.4, Class 1 tempered, 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**, thick unless otherwise indicated.

E. Foamed-Insulation-Core Metal Wall Panels
1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
   a. Panel Performance:
      1) Flatwise Tensile Strength: 30 psi (207 kPa) when tested according to ASTM C 297.
      2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
      3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.
      4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
      5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
      6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
   b. Polyisocyanurate Insulation-Core Performance:
      1) Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
      2) Compressive Strength: Minimum 20 psi (138 kPa) when tested according to ASTM D 1621.
      3) Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273.
2. Exposed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with raised, trapezoidal major rib at panel edge and two intermediate stiffening ribs symmetrically spaced between major rib and panel edge; designed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.
   a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
3) Backer Board: On back side of exterior facing.
4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
   a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
5) Interior Facing Finish: Manufacturer's standard white polyester.

b. Snap-On Batten: Same material, finish, and color as exterior facings of wall panels.
c. Panel Coverage: 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**, nominal.
d. Panel Thickness: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm), **as directed**.
e. Thermal-Resistance Value (R-Value): as directed by the Owner.

3. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
   1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
   3) Material: Stainless-steel sheet, 0.031 inch (0.79 mm) **OR** 0.038 inch (0.97 mm), **as directed**, thick with No. 4 **OR** 2B, **as directed**, finish.
   4) Backer Board: On back side of exterior facing.
   5) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
      a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   6) Interior Facing Finish: Manufacturer's standard siliconized polyester.
   7) Exterior Surface: Smooth, flat **OR** Striated **OR** Shallow ribs **OR** Shallow V grooves, **as directed**.
b. Panel Coverage: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 39.37 inches (1000 mm) **OR** 42 inches (1067 mm), **as directed**, nominal.
c. Panel Thickness: 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
d. Thermal-Resistance Value (R-Value): as directed by the Owner.

F. Laminated-Insulation-Core Metal Wall Panels
1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
a. Panel Performance:
   1) Flatwise Tensile Strength: 27 psi (186 kPa) when tested according to ASTM C 297.
   2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
   3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.

4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.

b. Polyisocyanurate Insulation-Core Performance:
1) Density: 1.8 to 2.3 lb/cu. ft. (29 to 37 kg/cu. m) when tested according to ASTM D 1622.
2) Compressive Strength: Minimum 20 psi (138 kPa) when tested according to ASTM D 1621.
3) Shear Strength: 24 psi (164 kPa) when tested according to ASTM C 273.

2. Wrapped-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching panels to supports using staggered, concealed side clips engaging panel edges **OR** through extended panel edges to supports using concealed fasteners, **as directed**; with sealant **OR** gasketed, **as directed**, joints.
a. Exterior Facing:
1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
4) Surface: Smooth, flat **OR** Embossed, **as directed**.
5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Interior Facing:
1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
4) Finish: Manufacturer's standard primer or white polyester.

c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
1) Backer Board: 0.125-inch- (3-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.

d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
e. Gaskets: Extruded, dry seal silicone.
f. Sealant: Manufacturer's standard silicone.
g. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
h. Thermal-Resistance Value (R-Value): as directed by the Owner.

3. Shiplap-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied sealant **OR** gaskets, **as directed**, in side laps.
   a. Exterior Facing:
      1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
      4) Surface: Smooth, flat **OR** Embossed, **as directed**.
      5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
         a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
   b. Interior Facing:
      1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
      4) Finish: Manufacturer's standard primer or white polyester.
   c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
      1) Backer Board: 0.125-inch- (3-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
   d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
   e. Gaskets: Extruded, dry seal silicone.
   f. Sealant: Manufacturer's standard silicone.
   g. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
   h. Thermal-Resistance Value (R-Value): as directed by the Owner.
4. Framed-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
   a. Exterior Facing:
      1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0-71 mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
      4) Surface: Smooth, flat **OR** Embossed, **as directed**.
      5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
         a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

b. Interior Facing:
   1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
   2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
   3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
   4) Finish: Manufacturer's standard primer or white polyester.

c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
   1) Backer Board: 0.125-inch- (3.18-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.

d. Edge Members: Extruded aluminum, not less than 0.063-inch (1.60-mm) wall thickness.

e. Gaskets: Extruded, dry seal silicone.

f. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.

g. Thermal-Resistance Value (R-Value): as directed by the Owner.

G. Honeycomb-Core Metal Wall Panels

1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and honeycomb-core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives or pinch rollers, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
   a. Panel Performance:
      1) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
      2) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.

2. Wrapped-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching panels to supports using staggered, concealed side clips engaging panel edges **OR** through extended panel edges to supports using concealed fasteners, **as directed**; with sealant **OR** gasketed, **as directed**, joints.
   a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
      1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
      4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
         a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
      5) Interior Facing Finish: Manufacturer's standard primer or polyester.
   b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
   c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.

d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
e. Gaskets: Extruded, dry seal silicone.
f. Sealant: Manufacturer's standard silicone.
g. Panel Thickness: 0.25 inch (6 mm) **OR** 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm), **as directed**.

3. Shiplap-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied sealant **OR** gaskets, **as directed**, in side laps.
   a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
      1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
      3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
      4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
         a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
      5) Interior Facing Finish: Manufacturer's standard primer or polyester.
   b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
   c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.
   d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
   e. Gaskets: Extruded, dry seal silicone.
   f. Sealant: Manufacturer's standard silicone.
   g. Panel Thickness: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 2.0 inches (51 mm), **as directed**.

4. Framed-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
   a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
      1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
      2) Material: Aluminum sheet, 0.040 inch (1.02 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
      3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
         a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
      4) Interior Facing Finish: Manufacturer's standard primer or polyester.
   b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
   c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.

d. Edge Members: Extruded aluminum, not less than 0.063-inch (1.6-mm) wall thickness.
e. Gaskets: Extruded, dry seal silicone.
f. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.

H. Accessories
1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
   a. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
   b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Flashing and Trim: Formed from 0.018-inch- (0.46-mm-) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

I. Fabrication
1. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
5. Honeycomb-Core Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum 10-psi (69-kPa) pressure. Use of contact adhesives with pinch-roll process is not acceptable.
   a. Panel Bow Tolerance: Not more than 0.5 percent of panel width or length.
6. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

J. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation
1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

B. Metal Wall Panel Installation, General
1. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
a. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.9 sq. m.) in presence of factory-authorized representative.
b. Shim or otherwise plumb substrates receiving metal wall panels.
c. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
d. Install screw fasteners in predrilled holes.
e. Locate and space fastenings in uniform vertical and horizontal alignment.
f. Install flashing and trim as metal wall panel work proceeds.
g. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
h. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
i. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
j. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
a. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
c. Copper Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
d. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
   a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
   b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

C. Insulated-Core Metal Wall Panel Installation
1. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
   a. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
   b. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   c. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
   d. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   e. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
   f. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
   g. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
2. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
   a. Install clips to supports with self-tapping fasteners.
3. Laminated-Insulation-Core Metal Wall Panels:
   a. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
   b. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
   c. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
      1) Horizontal Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
      2) Vertical Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
   d. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
4. Honeycomb-Core Metal Wall Panels:
   a. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.

b. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.

c. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.

1) Horizontal Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.

2) Vertical Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.

d. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

D. Accessory Installation

1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   a. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

E. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (299 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
5. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Cleaning And Protection

1. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On

completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

2. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 63 00

Task	Specification	Specification Description
07 46 63 00	07 46 16 00	Metal Wall Panels

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SECTION 07 51 13 00 - BUILT-UP ASPHALT ROOFING

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for built-up asphalt roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Built-up asphalt roofing.
   b. Vapor retarder.
   c. Roof insulation.
2. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Division 5 Section "Steel Deck."

C. Definitions
1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to built-up roofing.
2. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

D. Performance Requirements
1. General Performance: Installed built-up roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Built-up roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by built-up roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide built-up roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing: Provide built-up roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a built-up roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed**.
   b. Hail Resistance Rating: MH **OR** SH, **as directed**.
5. Energy Performance (for LEED-NC Credit SS 7.2): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
   a. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
   b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For built-up roofing. Include plans, elevations, sections, details, and attachments to other work.
   a. Base flashings and built-up terminations.
   b. Tapered insulation, including slopes.
   c. Crickets, saddles, and tapered edge strips, including slopes.
   d. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
4. Samples: For the following products:
   a. Built-up roofing materials, including base sheet, ply sheet, cap sheet, and flashing sheet, of color specified.
   b. Roof insulation.
   c. 3 lb (1.5 kg) of aggregate surfacing material in gradation and color indicated.
   d. Roof paver, full sized, in each color and texture required.
   e. Walkway pads.
   f. Six insulation fasteners of each type, length, and finish.
5. Qualification Data: For qualified Installer and manufacturer.
6. Manufacturer Certificates: Signed by roofing manufacturer certifying that built-up roofing complies with requirements specified in "Performance Requirements" Article.
   a. Submit evidence of compliance with performance requirements.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of built-up roofing.
8. Research/Evaluation Reports: For components of built-up roofing, from the ICC-ES.
9. Maintenance Data: For built-up roofing to include in maintenance manuals.
10. Warranties: Sample of special warranties.

F. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is UL listed **OR** FM Approvals approved, **as directed**, for built-up roofing identical to that used for this Project.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by built-up roofing manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
3. Source Limitations: Obtain components including roof insulation and fasteners for built-up roofing from same manufacturer as built-up roofing or approved by built-up roofing manufacturer.
4. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical built-up roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
5. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
6. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.

a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty

1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of built-up roofing that fail in materials or workmanship within specified warranty period.

a. Special warranty includes built-up roofing membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of built-up roofing.

b. Warranty Period: 10 **OR** 15 **OR** 20 **OR** 25 **OR** 30, **as directed**, years from date of Final Completion.

2. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of built-up roofing such as built-up roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

a. Warranty Period: Two years from date of Final Completion.

1.2 PRODUCTS

A. Built-Up Roofing Manufacturers

B. Base-Sheet Materials

1. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2. Base Sheet: ASTM D 4601, Type II, SBS-modified, asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.

a. Weight: 25 lb/100 sq. ft. (1.2 kg/sq. m) **OR** 40 lb/100 sq. ft. (1.95 kg/sq. m) **OR** 50 lb/100 sq. ft. (2.4 kg/sq. m) **OR** 60 lb/100 sq. ft. (3.0 kg/sq. m) **OR** 75 lb/100 sq. ft. (3.7 kg/sq. m), **as directed**, minimum.

OR

Base Sheet: ASTM D 4601, Type I **OR** II, **as directed**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

OR

Base Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

C. Roofing Membrane Plies

1. Ply Sheet: ASTM D 2178, Type IV **OR** VI, **as directed**, asphalt-impregnated, glass-fiber felt.

2. Cap Sheet: ASTM D 3909, asphalt-impregnated and -coated, glass-fiber cap sheet, with white coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface.

D. Base Flashing Sheet Materials
1. Backer Sheet: ASTM D 2178, Type IV **OR** VI, **as directed**, asphalt-impregnated, glass-fiber felt.
OR
Backer Sheet: ASTM D 4601, Type I **OR** II, **as directed**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
OR
Backer Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
2. Granule-Surfaced Flashing Sheet: ASTM D 6164, Grade G, Type I or II, polyester-reinforced **OR** ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced **OR** ASTM D 6162, Grade G, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
3. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, glass-fiber-reinforced, SBS-modified asphalt sheet; metal-foil surfaced; suitable for application method specified, and as follows:
a. Foil Surfacing: Aluminum **OR** Copper **OR** Stainless steel **OR** Aluminum, fluoropolymer coated finish, of color and gloss selected from manufacturer's full range, **as directed**.
4. Smooth-Surfaced Flashing Sheet: ASTM D 6222, Grade S, Type I or II, polyester-reinforced **OR** ASTM D 6223, Grade S, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, APP-modified asphalt sheet; smooth surfaced; suitable for application method specified.
OR
Granule-Surfaced Flashing Sheet: ASTM D 6222, Grade G, Type I or II, polyester-reinforced **OR** ASTM D 6223, Grade G, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, APP-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
5. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

E. Asphalt Materials
1. Asphalt Primer: ASTM D 41.
2. Roofing Asphalt: ASTM D 312, Type III **OR** IV **OR** III or IV as recommended by built-up roofing manufacturer for application, **as directed**.
3. Roofing Asphalt: ASTM D 6152, SEBS modified.

F. Auxiliary Built-Up Roofing Materials
1. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.
a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1) Plastic Foam Adhesives: 50 g/L.
2) Gypsum Board and Panel Adhesives: 50 g/L.
3) Multipurpose Construction Adhesives: 70 g/L.
4) Fiberglass Adhesives: 80 g/L.
5) Contact Adhesives: 80 g/L.
6) Other Adhesives: 250 g/L.
7) Nonmembrane Roof Sealants: 300 g/L.
8) Sealant Primers for Nonporous Substrates: 250 g/L.
9) Sealant Primers for Porous Substrates: 775 g/L.

2. Cold-Applied Adhesive: Roofing manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with built-up base flashings.
3. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing manufacturer for application.
4. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.
5. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.
6. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."
7. Aggregate Surfacing: ASTM D 1863, No. 6 or No. 67, clean, dry, opaque, water-worn gravel or crushed stone, free of sharp edges **OR** crushed slag, free of sharp edges, **as directed**.
8. Miscellaneous Accessories: Provide miscellaneous accessories recommended by built-up roofing manufacturer.

G. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
   OR
   Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
   OR
   Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
   OR
   Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

H. Vapor Retarder
1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
   a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
      OR
      Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper/polyethylene laminate, two layers, reinforced with woven fiberglass yarn, laminated and edge reinforced, with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
   OR
   Self-Adhering Sheet Vapor Retarder: 30- to 40-mil- (0.76- to 1.0-mm-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
4. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

I. Roof Insulation
1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578 Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
   a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
      OR
      Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface as indicated below by type, and felt or glass-fiber mat facer on the other surface.
   a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
   b. Type V, OSB facer, 7/16 inch (11 mm) thick.
   c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

J. Insulation Accessories
1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
   OR
   Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
   OR
   Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Insulation Cant Strips: ASTM C 728, perlite insulation board.
5. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

6. Wood Nailer Strips: Comply with requirements in Division 6 Section "Rough Carpentry" **OR** "Miscellaneous Carpentry", **as directed**.
7. Tapered Edge Strips: ASTM C 728, perlite insulation board.
   OR
   Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
8. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
   OR
   Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
   OR
   Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
   OR
   Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
9. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

K. Coating Materials
1. Roof Coating: ASTM D 1227, Type II Class 1, mineral-colloid-emulsified, fibered **OR** 2, chemically emulsified, filled or fibered, **as directed**, asphalt emulsion, asbestos free.
   OR
   Roof Coating: ASTM D 1227, Type III, Class 1, mineral-colloid-emulsified **OR** 2, chemically emulsified, **as directed**, asphalt emulsion, nonfibered.
   OR
   Roof Coating: ASTM D 2824, Type I, nonfibered **OR** III, fibered, asbestos-free, **as directed**, aluminum-pigmented asphaltic coating.
   OR
   Roof Coating: Acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces and complying with ASTM D 6083 **OR** the following, **as directed**:
   a. Initial Percent Elongation (Break): Not less than 60 percent at 0 deg F (-18 deg C) and 200 percent at 73 deg F (23 deg C) when tested according to ASTM D 2370.
   b. Initial Tensile Strength (Maximum Stress): Not less than 100 psi (1.38 MPa) at 73 deg F (23 deg C) and 200 psi (2.76 MPa) at 0 deg F (-18 deg C) when tested according to ASTM D 2370.
   c. Final Percent Elongation (Break) after Accelerated Weathering 1000 hrs.: Not less than 40 percent at 0 deg F (-18 deg C) and 100 percent at 73 deg F (23 deg C) when tested according to ASTM D 2370.
   d. Permeance: Not more than 50 perms when measured according to ASTM D 1653.
   e. Accelerated Weathering 1000 hrs.: No cracking or checking when tested according to ASTM D 4798.
   f. Color: White **OR** Gray **OR** Buff, **as directed**.

L. Walkways
1. Walkway Pads: Mineral-granule-surfaced, reinforced asphaltic composition **OR** Polymer-modified, reconstituted solid-rubber, surface-textured, **as directed**, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to roofing manufacturer, 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, minimum.
2. Walkway Cap Sheet Strips: ASTM D 6164, Grade G, Type I or II, polyester-reinforced **OR** ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced **OR** ASTM D 6162, Grade G, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
   a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
3. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not

greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:

a. Size: 24 by 24 inches (600 by 600 mm). Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
b. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum; ASTM C 140.
c. Colors and Textures: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination
1. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
a. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
c. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking".
d. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
e. Verify that minimum concrete drying period recommended by roofing manufacturer has passed.
f. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
1) Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
g. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
4. Install insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.

C. Substrate Board Installation
1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to built-up roofing manufacturer's written instructions.

D. Vapor-Retarder Installation
1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
   a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.

   OR

   Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
   a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.

      OR

      Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.

   OR

   Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.

   OR

   Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
2. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into built-up roofing.

E. Insulation Installation
1. Comply with built-up roofing manufacturer's written instructions for installing roof insulation.
2. Install one lapped base sheet course and mechanically fasten to substrate according to built-up roofing manufacturer's written instructions.
3. Nailer Strips: Mechanically fasten 4-inch nominal- (89-mm actual-) width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
   a. 16 feet (4.88 m) apart for roof slopes greater than 1 inch per 12 inches (1:12) but less than 3 inches per 12 inches (3:12).
   b. 48 inches (1220 mm) apart for roof slopes greater 3 inches per 12 inches (3:12).
4. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.
5. Install tapered insulation under area of roofing to conform to slopes indicated.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
   a. Where installing composite and noncomposite board insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
8. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
9. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
10. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
    a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.

b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

11. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure, fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

12. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure, fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
c. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

13. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**. Tape joints if required by roofing manufacturer.
a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
b. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
c. Apply hot roofing asphalt to underside and immediately bond cover board to substrate.

F. Built-Up Roofing Installation, General
1. Install roofing membrane according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
a. Install roofing system BU-3 **OR** 4 **OR** 5, **as directed**,-N **OR** I **OR** C, **as directed**,-A-A **OR** S **OR** M, **as directed**, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and requirements in this Section.

OR

Install roofing membrane according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:
a. Deck Type: N (nailable) **OR** I (insulated) **OR** C (concrete or nonnailable), **as directed**.
b. Base Sheet: 1 **OR** 1, installed over sheathing paper, **as directed**.
c. Number of Ply Sheets: 2 **OR** 3 **OR** 4, **as directed**.

d. Surfacing Type: A (aggregate) **OR** S (asphalt surfacing or coating) **OR** M (mineral-granule-surfaced cap sheet), **as directed**.
1) Mineral-granule-surfaced cap sheet is in addition to number of ply sheets specified.

2. Start installation of built-up roofing in presence of manufacturer's technical personnel.
3. Where roof slope exceeds 1/2 inch per 12 inches (1:24) **OR** 3/4 inch per 12 inches (1:18), **as directed**, install built-up roofing sheets parallel with slope.
a. Backnail built-up roofing sheets to nailer strips **OR** substrate, **as directed**, according to roofing manufacturer's written instructions.
4. Cooperate with testing agencies engaged or required to perform services for installing roofing.
5. Coordinate installation of roofing so insulation and other components of built-up roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
a. Provide tie-offs at end of each day's work to cover exposed built-up roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
c. Remove and discard temporary seals before beginning work on adjoining roofing.
6. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.
OR
Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing manufacturer's written instructions.
7. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

G. Roofing Membrane Installation
1. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
2. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
a. Mechanically fasten to substrate.
OR
Spot- or strip-mop to substrate with hot roofing asphalt.
OR
Adhere to substrate in a solid mopping of hot roofing asphalt, **as directed**.
3. Install two **OR** three **OR** four, **as directed**, ply sheets starting at low point of roofing. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.
a. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.
4. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.
a. Embed cap sheet in a solid mopping of hot roofing asphalt applied at rate required by built-up roofing manufacturer.
5. Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with 60 lb/100 sq. ft. (3.0 kg/sq. m) of hot roofing asphalt. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
a. Aggregate Weight: 400 lb/100 sq. ft. (20 kg/sq. m) **OR** 300 lb/100 sq. ft. (15 kg/sq. m), **as directed**.

b. If aggregate surfacing is delayed, promptly apply glaze coat of hot roofing asphalt at a rate of 10 lb/100 sq. ft. (0.5 kg/sq. m).

6. Glaze-coat roofing membrane surface with hot roofing asphalt applied at a rate of 10 to 15 lb/100 sq. ft. (0.5 to 0.75 kg/sq. m).

H. Flashing And Stripping Installation

1. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to built-up roofing manufacturer's written instructions and as follows:
   a. Prime substrates with asphalt primer if required by built-up roofing manufacturer.
   b. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over built-up roofing at cants in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive, **as directed**.
      OR
      Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive, **as directed**.
   c. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing manufacturer.
      OR
      Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing manufacturer.
      OR
      Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement at rate required by roofing manufacturer.
      OR
      Flashing Sheet Application: Torch apply flashing sheet to substrate.
2. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above built-up roofing and 4 inches (100 mm) onto field of built-up roofing.
3. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
   a. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.
4. Install stripping, according to roofing manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.
   a. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C), and extend onto roofing membrane.
      OR
      Flashing-Sheet Stripping: Install flashing-sheet stripping by heat welding and extend onto roofing membrane.
      OR
      Built-up Stripping: Install stripping of not less than two roofing membrane ply sheets, setting each ply in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt, and extend onto roofing membrane 4 inches (100 mm) and 6 inches (150 mm), respectively.
5. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of asphalt roofing cement on completed built-up roofing. Cover metal flashing with built-up roofing cap-sheet stripping and extend a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, beyond edge of metal flashing onto field of built-up roofing. Clamp built-up roofing, metal flashing, and stripping into roof-drain clamping ring.
   a. Install stripping according to roofing manufacturer's written instructions.

I. Coating Installation

1. Apply coating to built-up roofing and base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method to provide a dry film thickness of not less than 20 mils (0.5 mm).

J. Walkway Installation
1. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.
   a. Set walkway pads in additional pour coat of hot roofing asphalt after sweeping away loose aggregate surfacing.
2. Walkway Cap Sheet Strips: Install walkway cap sheet strips, approximately 36 inches (900 mm) wide and in lengths not exceeding 10 feet (3 m), leaving a space of 6 inches (150 mm) between strips, over built-up roofing. Adhere in hot roofing asphalt.
3. Roof-Paver Walkways: Install walkway roof pavers according to roofing manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.

K. Field Quality Control
1. Testing Agency: Perform roof tests and inspections and to prepare test reports.
2. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of built-up roofing as follows:
   a. Approximate quantities of components within built-up roofing will be determined according to ASTM D 3617.
   b. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
   c. Repair areas where test cuts were made according to roofing manufacturer's written instructions.
3. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.
   a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

L. Protecting And Cleaning
1. Protect built-up roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and the Owner.
2. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 51 13 00

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Task	Specification	Specification Description
07 51 13 00	06 05 23 00a	Miscellaneous Carpentry
07 51 13 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 51 13 00	07 53 16 00	EPDM Membrane Roofing
07 51 13 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 51 13 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 51 13 00	07 05 13 00d	Preparation for Re-Roofing
07 52 13 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 52 13 00	07 05 13 00d	Preparation for Re-Roofing
07 52 16 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 52 16 00	07 05 13 00d	Preparation for Re-Roofing

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SECTION 07 53 16 00 - EPDM MEMBRANE ROOFING

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for ethylene-propylene-diene-monomer (EPDM) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Adhered EPDM membrane roofing system.
b. Mechanically fastened EPDM membrane roofing system.
c. Loosely laid and ballasted EPDM membrane roofing system.
d. Vapor retarder.
e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions
1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Performance Requirements
1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.
a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance (for “cool-roof” performance): Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency, **as directed**.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**,-slope roof products, **as directed**.
7. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:

a. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
4. Samples: For each product included in the roofing system.
5. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
   a. Submit evidence of complying with performance requirements.
6. Research/evaluation reports.
7. Field quality-control reports.
8. Maintenance data.
9. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
5. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. EPDM Membrane Roofing
1. EPDM: ASTM D 4637, Type I, non-reinforced, **OR** Type II, scrim or fabric internally reinforced, **as directed**, uniform, flexible EPDM sheet.
   a. Thickness: 45 mils (1.1 mm) **OR** 60 mils (1.5 mm) **OR** 75 mils (1.9 mm) **OR** 90 mils (2.2 mm), **as directed**, nominal.
   b. Exposed Face Color: Black **OR** White on black, **as directed**.
2. Fabric-Backed EPDM: ASTM D 4637, Type III, non-reinforced, uniform, flexible EPDM sheet, laminated to a nonwoven polyester fabric backing except at selvages.
   a. Composite Thickness: 90 mils (2.3 mm) **OR** 100 mils (2.5 mm) **OR** 105 mils (2.7 mm) **OR** 115 mils (2.9 mm), **as directed**, nominal.
   b. Exposed Face Color: Black **OR** White on black, **as directed**.

B. Auxiliary Membrane Roofing Materials
1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
   b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      1) Plastic Foam Adhesives: 50 g/L.
      2) Gypsum Board and Panel Adhesives: 50 g/L.
      3) Multipurpose Construction Adhesives: 70 g/L.
      4) Fiberglass Adhesives: 80 g/L.
      5) Contact Adhesive: 80 g/L.
      6) Single-Ply Roof Membrane Sealants: 450 g/L.
      7) Nonmembrane Roof Sealants: 300 g/L.
      8) Sealant Primers for Nonporous Substrates: 250 g/L.
      9) Sealant Primers for Porous Substrates: 775 g/L.
      10) Other Adhesives and Sealants: 250 g/L.
2. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
3. Protection Sheet: Epichlorohydrin or neoprene non-reinforced flexible sheet, 55- to 60-mil- (1.4- to 1.5-mm-) thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
4. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
5. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
6. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
7. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
8. Seaming Material: Single-component, butyl splicing adhesive and splice cleaner **OR** Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film, **as directed**.
9. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing, **as directed**.
10. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
11. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
12. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

13. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
14. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
15. Liquid coating, specifically formulated for coating EPDM membrane roofing, as follows:
    a. Type: Acrylic emulsion **OR** Hypalon, **as directed**.
    b. Color: White **OR** Gray **OR** Tan **OR** As selected from manufacturer's full range, **as directed**.

C. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
   OR
   Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
   OR
   Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
   OR
   Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

D. Vapor Retarder
1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
   a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
   b. Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation
1. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
   a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
      OR
      Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.

5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
   a. Type IV, cellulosic-fiber-insulation-board facer, Grade 2, 1/2 inch (13 mm) thick.
   b. Type V, OSB facer, 7/16 inch (11 mm) thick.
   c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Insulation Accessories
1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
   OR
   Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
   OR
   Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
   OR
   Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

G. Asphalt Materials
1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
2. Asphalt Primer: ASTM D 41.

H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)

1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
   a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
   b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
      OR
      Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
      OR
      Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).

I. Roof Pavers
1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
   a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
   b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
   c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.
2. Rubber Roof Pavers: Interlocking, lightweight rubber units, 24 by 24 by 2-1/4 inches (600 by 600 by 57 mm), 6 lb/sq. ft. (30 kg/sq. m) specially manufactured for use as roof ballast; with grooved back for four-way drainage, beveled and doweled; and as follows:
   a. Perimeter Securement Strip: Manufacturer's standard coated steel sheet channel **OR** aluminum sheet channel **OR** mill-finish aluminum sheet hold down **OR** coated aluminum sheet hold down, color as selected, **as directed**, and fasteners.
   b. Color: Black **OR** Gray **OR** Terra cotta, **as directed**.
3. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
   b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
   c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

J. Walkways
1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
   b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
   c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

1.3 EXECUTION

A. Preparation
1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board
1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
      OR
      Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation
1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
   a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
   a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
      OR
      Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-Up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation
1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
   b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
   c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      OR
      Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
      OR
      Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
9. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
      OR
      Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
      OR
      Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      OR
      Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
    a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
       OR
       Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

E. Adhered Membrane Roofing Installation
   1. Adhere membrane **OR** fabric-backed membrane, **as directed**, roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
5. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer and install fabric-backed membrane roofing. Do not apply to splice area of membrane roofing.
   OR
   Fabric-Backed Membrane Adhesive: Apply to substrate at rate required by manufacturer and install fabric-backed membrane roofing.
6. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
7. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
8. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
   a. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
9. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
10. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
11. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
12. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
13. Adhere protection sheet over membrane roofing at locations indicated.

F. Mechanically Fastened Membrane Roofing Installation
1. Mechanically fasten membrane roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
   a. For in-splice attachment, install membrane roofing with long dimension perpendicular to steel roof deck flutes.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
   a. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
7. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
8. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

9. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
10. In-Splice Attachment: Secure one edge of membrane roofing using fastening plates or metal battens centered within membrane splice and mechanically fasten membrane roofing to roof deck. Field splice seam.
    OR
    Through-Membrane Attachment: Secure membrane roofing using fastening plates or metal battens and mechanically fasten membrane roofing to roof deck. Cover battens and fasteners with a continuous cover strip.
11. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
12. Adhere protection sheet over membrane roofing at locations indicated.

G. Loosely Laid And Ballasted Membrane Roofing Installation
1. Loosely lay membrane roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
    a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.
    OR
    Mechanically fasten or adhere membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
    a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.
    b. At corners and perimeters, adhere a second layer of membrane roofing
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
    a. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
7. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
8. Leave seams uncovered until inspected by membrane roofing system manufacturer **OR** testing agency, **as directed**.
9. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
10. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
11. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
12. Adhere protection sheet over membrane roofing at locations indicated.
13. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).
14. Aggregate Ballast, **as directed**: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.

a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).
OR
Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.
OR
Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).

15. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.
OR
Roof-Paver Ballast: Install rubber roof-paver ballast according to manufacturer's written instructions, in locations indicated.
a. Install perimeter paver edge securement.
OR
Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
b. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).
OR
Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).

H. Base Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
4. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.

I. Coating Installation
1. Apply coatings to membrane roofing **OR** base flashings, **as directed**, according to manufacturer's written recommendations, by spray, roller, or other suitable application method.

J. Walkway Installation
1. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.

K. Field Quality Control
1. Testing Agency: Engage a qualified independent testing agency to perform inspections.
2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

L. Protecting And Cleaning

1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 53 16 00

Task	Specification	Specification Description
07 53 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 16 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 53 16 00	07 05 13 00a	CSPE Membrane Roofing
07 53 16 00	07 05 13 00d	Preparation for Re-Roofing
07 53 23 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 23 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 53 23 00	07 53 16 00	EPDM Membrane Roofing
07 53 23 00	07 05 13 00d	Preparation for Re-Roofing
07 53 29 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 29 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 53 29 00	07 53 16 00	EPDM Membrane Roofing
07 53 29 00	07 05 13 00d	Preparation for Re-Roofing

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SECTION 07 54 19 00 - POLYVINYL-CHLORIDE (PVC) ROOFING

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for polyvinyl-chloride (PVC) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Adhered PVC membrane roofing system.
   b. Mechanically fastened PVC membrane roofing system.
   c. Loosely laid and ballasted PVC membrane roofing system.
   d. Vapor retarder.
   e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions
1. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

D. Performance Requirements
1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing, **as directed**: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
   b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**,-slope roof products.
7. Energy Performance(for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

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

2. LEED Submittals:
   a. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
   b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
4. Samples: For each product included in the roofing system.
5. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   a. Submit evidence of compliance with performance requirements.
6. Research/evaluation reports.
7. Field quality-control reports.
8. Maintenance data.
9. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
5. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. PVC Membrane Roofing
1. PVC Sheet: ASTM D 4434, Type II, Grade I, glass fiber reinforced, felt backed.
a. Thickness: 48 mils (1.2 mm), minimum **OR** 60 mils (1.5 mm), nominal **OR** 72 mils (1.8 mm) **OR** 80 mils (2.0 mm) **OR** 96 mils (2.4 mm), **as directed**.
b. Exposed Face Color: Gray.
OR
PVC Sheet: ASTM D 4434, Type III, fabric reinforced and fabric backed, **as directed**.
a. Thickness: 45 mils (1.1 mm), minimum **OR** 48 mils (1.2 mm) **OR** 50 mils (1.27 mm) **OR** 60 mils (1.5 mm), nominal **OR** 72 mils (1.8 mm) **OR** 80 mils (2.0 mm) **OR** 100 mils (2.5 mm), **as directed**.
b. Exposed Face Color: White **OR** Gray, **as directed**.
OR
PVC Sheet: ASTM D 4434, Type IV, fabric reinforced and fabric backed, **as directed**.
a. Thickness: 36 mils (0.9 mm), minimum **OR** 40 mils (1.0 mm), nominal **OR** 50 mils (1.27 mm) **OR** 60 mils (1.5 mm), nominal **OR** 72 mils (1.8 mm) **OR** 80 mils (2.0 mm) **OR** 100 mils (2.5 mm), **as directed**.
b. Exposed Face Color: White **OR** Gray, **as directed**.

B. Auxiliary Membrane Roofing Materials
1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1) Plastic Foam Adhesives: 50 g/L.
2) Gypsum Board and Panel Adhesives: 50 g/L.
3) Multipurpose Construction Adhesives: 70 g/L.
4) Fiberglass Adhesives: 80 g/L.
5) Contact Adhesive: 80 g/L.
6) Other Adhesives: 250 g/L.
7) PVC Welding Compounds: 510 g/L.
8) Adhesive Primer for Plastic: 650 g/L
9) Single-Ply Roof Membrane Sealants: 450 g/L.
10) Nonmembrane Roof Sealants: 300 g/L.
11) Sealant Primers for Nonporous Substrates: 250 g/L.
12) Sealant Primers for Porous Substrates: 775 g/L.
2. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
3. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
4. Slip Sheet: Manufacturer's standard, of thickness required for application.
5. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
6. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.
7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

C. Substrate Boards

1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
   OR
   Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
   OR
   Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
   OR
   Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

D. Vapor Retarder
1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
   a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
      OR
      Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation
1. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
   a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
      OR
      Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
   a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
   b. Type V, OSB facer, 7/16 inch (11 mm) thick.
   c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.

8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), **as directed**, unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Insulation Accessories
1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

G. Asphalt Materials
1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
2. Asphalt Primer: ASTM D 41.

H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)
1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
   a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
   b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
   OR
   Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
   OR
   Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).

I. Roof Pavers
1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
   a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
   b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
   c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.
2. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
   b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
   c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

J. Walkways
1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
   b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
   c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

1.3 EXECUTION

A. Preparation
1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board
1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation
1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
   a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
   a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
   OR
   Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation
1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
   a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
   b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
   c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   d. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
      OR
      Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
9. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
      OR
      Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
      OR
      Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      OR
      Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
    a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
       OR
       Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
12. Install slip sheet over insulation **OR** cover board, **as directed**, and immediately beneath membrane roofing.

E. Adhered Membrane Roofing Installation
1. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
   a. Install sheet according to ASTM D 5036.
2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

F. Mechanically Fastened Membrane Roofing Installation
1. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
   a. Install sheet according to ASTM D 5082.
   b. For in-splice attachment, install membranes roofing with long dimension perpendicular to steel roof deck flutes.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. In-Seam Attachment: Secure one edge of PVC sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten PVC sheet to roof deck.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

G. Loosely Laid And Ballasted Membrane Roofing Installation
1. Loosely lay membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
   a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.

   OR

   Mechanically fasten **OR** adhere, **as directed**, membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
   a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.

      OR

      At corners and perimeters, adhere a second layer of membrane roofing.
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

7. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
8. Install membrane roofing and auxiliary materials to tie in to existing roofing.
9. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).
10. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.
    a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).

       OR

       Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.

       OR

       Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).
11. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.

    OR

    Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
    a. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).

       OR

       Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).

H. Base Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
4. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.

I. Walkway Installation
1. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.

J. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

K. Protecting And Cleaning
1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

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Task	Specification	Specification Description
07 54 19 00	07 05 13 00d	Preparation for Re-Roofing

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SECTION 07 54 23 00 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for thermoplastic polyolefin (TPO) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Adhered TPO membrane roofing system.
   b. Mechanically fastened TPO membrane roofing system.
   c. Loosely laid and ballasted TPO membrane roofing system.
   d. Vapor retarder.
   e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions
1. TPO: Thermoplastic polyolefin.
2. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Performance Requirements
1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing, **as directed**: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
   b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**,-slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
   a. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
   b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
4. Samples: For each product included in the roofing system.
5. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   a. Submit evidence of compliance with performance requirements.
6. Research/evaluation reports.
7. Field quality-control reports.
8. Maintenance data.
9. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
5. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty

1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. TPO Membrane Roofing
1. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed, **as directed**, TPO sheet.
   a. Thickness: 45 mils (1.1 mm) **OR** 60 mils (1.5 mm), **as directed**, nominal.
   b. Exposed Face Color: Black **OR** Gray **OR** Tan **OR** White, **as directed**.

B. Auxiliary Membrane Roofing Materials
1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
   a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
   b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      1) Plastic Foam Adhesives: 50 g/L.
      2) Gypsum Board and Panel Adhesives: 50 g/L.
      3) Multipurpose Construction Adhesives: 70 g/L.
      4) Fiberglass Adhesives: 80 g/L.
      5) Contact Adhesive: 80 g/L.
      6) Other Adhesives: 250 g/L.
      7) Single-Ply Roof Membrane Sealants: 450 g/L.
      8) Nonmembrane Roof Sealants: 300 g/L.
      9) Sealant Primers for Nonporous Substrates: 250 g/L.
      10) Sealant Primers for Porous Substrates: 775 g/L.
2. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.
3. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
4. Slip Sheet: Manufacturer's standard, of thickness required for application.
5. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
6. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

C. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
   OR
   Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
   OR
   Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
   OR

Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.

2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

D. Vapor Retarder

1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
   a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
      OR
      Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
   a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
      OR
      Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
   a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
   b. Type V, OSB facer, 7/16 inch (11 mm) thick.
   c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Insulation Accessories

1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
   OR
   Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
   OR
   Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
   OR
   Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

G. Asphalt Materials
1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
2. Asphalt Primer: ASTM D 41.

H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)
1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
   a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
   b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
      OR
      Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
      OR
      Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).

I. Roof Pavers
1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
   a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
   b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
   c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

2. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
   b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
   c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

J. Walkways
1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
   b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
   c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
   d. Colors and Textures: As selected from manufacturer's full range.

1.3 EXECUTION

A. Preparation
1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board
1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
   OR
   Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
   a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
   a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
      OR
      Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation
1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
   a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
   b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
   c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   d. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
      OR
      Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

9. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
      OR
      Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
      OR
      Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      OR
      Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
    a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
       OR
       Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
12. Install slip sheet over insulation **OR** cover board, **as directed**, and immediately beneath membrane roofing.

E. Adhered Membrane Roofing Installation
1. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system, **as directed**.

F. Mechanically Fastened Membrane Roofing Installation

1. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
   a. For in-splice attachment, install membranes roofing with long dimension perpendicular to steel roof deck flutes.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten TPO sheet to roof deck.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

G. Loosely Laid And Ballasted Membrane Roofing Installation
1. Loosely lay membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
   a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.
   OR
   Mechanically fasten **OR** adhere, **as directed**, membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
   a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.
      OR
      At corners and perimeters, adhere a second layer of membrane roofing.
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
7. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
8. Install membrane roofing and auxiliary materials to tie in to existing roofing.
9. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).

10. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.
    a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).
       OR
       Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.
       OR
       Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).
11. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.
    OR
    Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
    a. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).
       OR
       Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).

H. Base Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
4. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.

I. Walkway Installation
1. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.

J. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

K. Protecting And Cleaning
1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.

2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23 00

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Task	Specification	Specification Description
07 54 23 00	07 05 13 00d	Preparation for Re-Roofing

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SECTION 07 56 00 00 - COATED FOAMED ROOFING

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for coated foamed roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Spray-applied, polyurethane foam insulation.
b. Elastomeric roof coatings.
c. Mineral granules.
d. Aggregate.
e. Walkways.

C. Performance Requirements
1. Watertightness: Provide coated foamed roofing that is watertight and will not permit the passage of water.
2. Material Compatibility: Provide polyurethane foam, elastomeric coatings, and miscellaneous roofing materials that are compatible with one another and able to bond to substrate under conditions of service and application required, as demonstrated by coated foamed roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide a coated foamed roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to SEI/ASCE 7.
4. FMG Listing: Provide roofing system and component materials that comply with requirements in FMG 4450 for steel roof decks and FMG 4470 for roof covers as part of a foamed roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
a. Fire/Windstorm Classification: Class 1A-60 **OR** 75 **OR** 90 **OR** 105 **OR** 120, **as directed**.
b. Hail-Resistance Classification: MH **OR** SH, **as directed**.
5. Energy Performance: Provide roofing system with Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
3. Samples: For each exposed product and for each color and texture specified.
4. Research/evaluation reports.
5. Maintenance data.
6. Warranty: Sample of special warranty.
7. Warranty: Sample of special warranty.

E. Quality Assurance
1. Installer Qualifications: A qualified installer who is approved, authorized, or licensed by roof coating manufacturer for installation of manufacturer's product over polyurethane foam.

a. Engage an installer who participates in and who has fulfilled requirements of the SPFA Accreditation Program for company accreditation and individual applicator accreditation for personnel assigned to work on Project.

2. Source Limitations: Obtain polyurethane foam materials from single source or producer and coating products from single, coated foamed roofing manufacturer.
3. Fire-Test-Response Characteristics: Provide coated foamed roofing systems with the fire-test-response characteristics indicated, as determined by testing identical systems per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   a. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively; ASTM E 84.
   b. Exterior Fire-Test Exposure: ASTM E 108; Class A.
   c. Fire-Resistance Ratings: ASTM E 119, determined for coated polyurethane foam roofing as part of a roof assembly.
4. Comply with recommendations in NRCA's "Quality Control Guidelines for the Application of Spray Polyurethane Foam Roofing."
5. Comply with recommendations in SPFA AY 104, "Spray Polyurethane Foam Systems for New and Remedial Roofing."
6. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Deliver materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
2. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by manufacturer. Protect stored materials from direct sunlight.
3. Remove and replace material that cannot be applied within its stated shelf life.

G. Warranty
1. Special Warranty: Coated foamed roofing manufacturer's standard form in which manufacturer agrees to repair or replace coated foamed roofing that does not comply with requirements or that does not remain watertight within five **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Polyurethane Foam
1. Polyurethane Foam: Rigid cellular polyurethane, spray applied, produced by the catalyzed chemical reaction of polyisocyanates with polyhydroxyls, with stabilizers, fire retardants, and blowing agents added; and complying with ASTM C 1029, Type III, as certified by a qualified independent testing agency.
   a. In-Place Density: 2.8 to 3.0 lb/cu. ft. (44.9 to 48.1 kg/cu. m); ASTM D 1622.
   b. Surface-Burning Characteristic: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      1) Flame-Spread Index: 75 or less.

B. Urethane Coatings
1. Urethane Coatings: Liquid urethane elastomeric coating system, specifically formulated for coating spray polyurethane roofing, of the following composition, coat type, and topcoat color and complying with specified performance and physical requirements.
   a. Base-Coat Composition and Type: One-component **OR** Two-component, **as directed**, aromatic urethane.

b. Topcoat Composition and Type: One-component **OR** Two-component, **as directed**, aromatic **OR** aliphatic, **as directed**, urethane.
c. Topcoat Color: White **OR** Gray **OR** Tan **OR** Copper **OR** Black, **as directed**.
d. Topcoat Color at Walkways: White **OR** Gray **OR** Tan **OR** Copper **OR** Black, **as directed**.
e. Tensile Strength: 400 psi (2.8 MPa) per ASTM D 412.
f. Elongation: 300 percent at 75 deg F (24 deg C) per ASTM D 412.
g. Permanent Set at Break: 30 percent maximum per ASTM D 412.
h. Tear Resistance: 100 lbf/inch (17.5 kN/m) per ASTM D 1004.
i. Water Absorption: 3 percent maximum by weight, 168 hours at 75 deg F (24 deg C) per ASTM D 471.
j. Permeance:
1) Minimum 0.7 perms (40.2 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.
OR
Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.

C. Silicone Coatings
1. Silicone Coatings: Liquid silicone elastomeric coating system, complying with ASTM D 6694 and specifically formulated for coating spray polyurethane roofing.
a. Base-Coat and Topcoat Composition: One-component **OR** Two-component, **as directed**, silicone.
b. Topcoat Color: White **OR** Gray,**as directed** .
c. Topcoat Color at Walkways: White **OR** Gray, **as directed**.
d. Permeance: Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.

D. Acrylic Coatings
1. Acrylic Coatings: Liquid acrylic elastomeric emulsion coating system, complying with ASTM D 6083 and specifically formulated for coating spray polyurethane roofing.
a. Topcoat Color: White **OR** Gray **OR** Buff, **as directed**.
b. Topcoat Color at Walkways: White **OR** Gray **OR** Buff, **as directed**.
c. Permeance: Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.

E. Substrate Board
1. Thermal Barrier:
a. Glass-mat, water-resistant gypsum board, ASTM C 1177/C 1177M, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), Type X, **as directed**.
b. ASTM C 36/C 36M, 5/8-inch (16-mm) gypsum board base, Type X.
2. Recovery Board and Fasteners: As recommended by polyurethane foam manufacturer, and meeting the requirements of Division 07 Section "Preparation For Re-roofing".
3. Thermal-Barrier Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, and designed and sized for fastening thermal barrier to substrate.

F. Auxiliary Materials
1. Primer: Polyurethane foam manufacturer's standard factory-formulated primer.
2. Vapor Retarder: Fluid applied **OR** Bituminous membrane **OR** As recommended by coated foamed roofing manufacturer, **as directed**.
3. Mineral Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained by No. 40 (0.42-mm) sieve.
a. Color: Buff white **OR** Gray **OR** Green **OR** Red, **as directed**.
4. Aggregate: Coarse mineral aggregate, 3/4 inch (19 mm) maximum, ASTM D 1863, No. 7 or No. 67 gradation.

5. Reinforcement: Flexible polyester or fiberglass mat of weight, type, and composition recommended by roof coating manufacturer for embedment in liquid coating.
6. Walkway Pads: Factory formed of nonwoven PVC strands, porous, UV stabilized, of 5/16-inch (8-mm) nominal thickness, and approved by roof coating manufacturer. Provide pad sizes indicated.
   a. Color: Yellow **OR** Gray **OR** Blue **OR** Orange **OR** Green, **as directed**.
7. Sealant: ASTM C 920, Class 25, Use NT, Grade NS, Type M, multicomponent urethane **OR** Type S, one-component, neutral- or acid-curing silicone, **as directed**, and as recommended by coated foamed roofing manufacturer for substrate and joint conditions and for compatibility with roofing materials.
8. Sheet Flashing and Accessories: Types recommended by coated foamed roofing manufacturer, provided at locations indicated and as recommended by coated foamed roofing manufacturer.

1.3 EXECUTION

A. Substrate Board
1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   a. Fasten thermal barrier to top flanges of steel deck according to recommendations in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
   b. Fasten thermal barrier to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to coated foamed roofing manufacturer's written instructions.
   c. Install recovery board according to coated foamed roofing manufacturer's written instructions and the requirements of Division 07 Section "Preparation For Re-roofing". Fasten through existing roofing to roof structure as indicated. Space fasteners for wind-uplift conditions at Project site **OR** as indicated, **as directed**.

B. Surface Preparation
1. Clean and prepare substrate according to coated foamed roofing manufacturer's written instructions. Provide clean, dust-free, dew-free, and dry substrate for coated foamed roofing application.
2. Remove grease, oil, form-release agents, curing compounds, and other contaminants from substrate.
3. Prepare substrate for recovering according toDivision 07 Section "Preparation For Re-roofing" and to coated foamed roofing manufacturer's written instructions.
4. Cover and mask adjoining surfaces not receiving coated foamed roofing to prevent overspray or spillage affecting other construction. Close off roof drains, removing roof-drain plugs when no work is being done or when rain is forecast.
   a. Remove masking after polyurethane foam application and remask adjoining substrates before coating.
5. Prime substrate if recommended by coated foamed roofing manufacturer.
6. Fill, cover, or tape joints and cracks in substrate that exceed a width of 1/4 inch (6 mm). Remove dust and dirt from joints and cracks before applying polyurethane foam.
7. Install vapor retarder according to coated foamed roofing manufacturer's written instructions.

C. Polyurethane Foam Application
1. General: Mix and apply polyurethane foam according to ASTM D 5469 and coated foamed roofing manufacturer's written instructions.
   a. Fill irregularities and areas of ponding.
   b. Apply the required full thickness of polyurethane foam in any specific area on same day.
   c. Apply only the area of polyurethane foam that can be covered on same day with required base coating.
   d. Apply polyurethane foam to avoid overspray beyond immediate area of work.

2. Apply polyurethane foam in lift thicknesses not less than 1/2 inch (13 mm) and not more than 1-1/2 inches (38 mm).
3. Uniformly apply total thickness of polyurethane foam indicated, but not less than 1 inch (25 mm), to a surface tolerance of plus 1/4 inch (6 mm) and no minus.
4. Apply polyurethane foam to roof penetrations, terminations, and vertical surfaces as indicated. Unless otherwise indicated, extend polyurethane foam at least 4 inches (100 mm) above elevation of adjacent roof field.
5. Surface Finish: Provide finished surface of polyurethane foam within the following range of surface textures as defined by ASTM D 5469:
   a. Texture: Smooth to orange peel **OR** coarse orange peel **OR** rippling verge of popcorn, **as directed**.
6. Remove and replace polyurethane foam not complying with minimum surface-texture limitations. Remove defective thickness and prepare and reapply polyurethane foam with acceptable, uniform results.

D. Coating Application
1. Allow polyurethane foam substrate to cure for a minimum of two hours and remove dust, dirt, water, and other contaminants before applying coating.
2. Apply coating system to polyurethane foam, in two or more coats and according to roof coating manufacturer's written instructions, by spray, roller, or other suitable application method.
3. Apply base coat and one or more topcoats to obtain a uniform, seamless membrane free of blisters and pinholes. Apply each coat at right angles to preceding coat, using contrasting colors for successive coats.
   a. Apply base coat on same day as polyurethane foam is applied and allow it to cure.
   b. Apply topcoat(s) after removing dust, dirt, water, and other contaminants from base coat.
   c. Urethane Coating: Apply base coat and topcoat to a minimum dry film thickness recommend by coated foamed roofing manufacturer **OR** of 25 mils (0.64 mm) **OR** of 30 mils (0.76 mm) **OR** of 35 mils (0.89 mm), **as directed**.
   d. Silicone Coating: Apply base coat and topcoat to a minimum dry film thickness recommend by coated foamed roofing manufacturer **OR** of 20 mils (0.50 mm) **OR** of 22 mils (0.56 mm) **OR** of 26 mils (0.66 mm) **OR** of 30 mils (0.76 mm), **as directed**.
   e. Acrylic Coating: Apply base coat and topcoat to a minimum dry film thickness recommend by coated foamed roofing manufacturer **OR** of 25 mils (0.64 mm) **OR** of 28 mils (0.71 mm) **OR** of 32 mils (0.81 mm), **as directed**.
4. Apply coating system at wall terminations and vertical surfaces to extend beyond polyurethane foam by 4 inches (100 mm), minimum.
5. Mineral Granules: Apply mineral granules over wet topcoat using pressure equipment at the rate of 0.5 lb/sq. ft. (2.45 kg/sq. m). Remove excess granules after topcoat has cured.
6. Sealant: Apply sealant to perimeter and other terminations where indicated or required by coated foamed roofing manufacturer.
7. Walkways: Install roof walkways in pattern and locations indicated. Mask off completed roof coating adjacent to walkways and apply one or two additional topcoats to achieve a minimum dry film thickness recommended by coated foamed roofing manufacturer. Spread mineral granules uniformly at a rate of 0.5 lb/sq. ft. (2.45 kg/sq. m) into final wet coating. Remove masking and excess granules after topcoat has cured.
8. Walkways: Install roof walkways in pattern and locations indicated. Mask off completed roof coating adjacent to walkways and apply one additional topcoat to achieve a minimum dry film thickness recommended by coated foamed roofing manufacturer. Lay reinforcing fabric into wet coating and apply another topcoat, completely filling fabric. Spread mineral granules uniformly at a rate of 0.5 lb/sq. ft. (2.45 kg/sq. m) into final wet coating. Remove masking and excess granules after topcoat has cured.
9. Walkways: Install walkway pads in pattern and locations indicated. Adhere walkway pads to substrate with compatible adhesive according to coated foamed roofing manufacturer's written instructions.
10. Aggregate: Apply aggregate uniformly over coated polyurethane foam at coated foamed roofing manufacturer's recommended rate, but not less than 6 lb/sq. ft. (29 kg/sq. m) and a minimum

thickness of 3/4 inch (19 mm). Spread with care to prevent puncturing coating and to minimize damage to substrate foam.

E. Field Quality Control
1. Correct deficiencies in, or remove, foam or coatings that do not comply with requirements; fill and repair substrates and reapply materials.
2. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.
3. Refill cores, repair slits, and recoat test areas.

F. Repair And Recoating
1. Repair and recoat coated foamed roofing according to ASTM D 6705 and coated foamed roofing manufacturer's written instructions.

G. Curing, Protecting, And Cleaning
1. Cure coatings according to coated foamed roofing manufacturer's written instructions, taking care to prevent contamination and damage during application stages and curing. Do not permit traffic on uncured coatings.
2. Protect coated foamed roofing from damage and wear during remainder of construction period.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 56 00 00

Task	Specification	Specification Description
07 56 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 56 00 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 56 00 00	07 53 16 00	EPDM Membrane Roofing
07 58 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 62 13 00	04 05 23 16	Sheet Metal Flashing And Trim

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SECTION 07 63 00 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for common work results for fire suppression. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Piping materials and installation instructions common to most piping systems.
b. Mechanical sleeve seals.
c. Sleeves.
d. Escutcheons.
e. Grout.
f. Fire-suppression equipment and piping demolition.
g. Equipment installation requirements common to equipment sections.
h. Painting and finishing.
i. Concrete bases.
j. Supports and anchorages.

C. Definitions
1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
a. CPVC: Chlorinated polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
a. EPDM: Ethylene-propylene-diene terpolymer rubber.
b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals
1. Welding certificates.

E. Quality Assurance
1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

3. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling
1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings
1. Refer to individual Division 28 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials
1. Refer to individual Division 28 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
      1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

C. Mechanical Sleeve Seals
1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
   c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

D. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set screws.
5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

E. Escutcheons
1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
   a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

F. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
   c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Fire-Suppression Demolition
1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

B. Piping Systems - Common Requirements
1. Install piping according to the following requirements and Division 28 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
    a. New Piping:
        1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
        2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
        3) Insulated Piping: One-piece, stamped-steel type with spring clips.
        4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
            a) One-piece, cast-brass type with polished chrome-plated finish.
            OR
            One-piece, stamped-steel type.
        5) Bare Piping at Ceiling Penetrations in Finished Spaces:
            a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
            OR
            One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
        6) Bare Piping in Unfinished Service Spaces:
            a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
            OR
            One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
        7) Bare Piping in Equipment Rooms:
            a) One-piece, cast-brass type.

            One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
        8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
    b. Existing Piping: Use the following:

    c. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
    d. Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
        1) Split-casting, cast-brass type with chrome-plated finish.
        OR
        Split-plate, stamped-steel type with concealed hinge and spring clips.

f. Bare Piping at Ceiling Penetrations in Finished Spaces:
   1) Split-casting, cast-brass type with chrome-plated finish.
      OR
      Split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces:
   1) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
      OR
      Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
h. Bare Piping in Equipment Rooms:
   1) Split-casting, cast-brass type.
      OR
      Split-plate, stamped-steel type with set screw or spring clips.
i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

13. Sleeves are not required for core-drilled holes.
14. Permanent sleeves are not required for holes formed by removable PE sleeves.
15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    a. Cut sleeves to length for mounting flush with both surfaces.
       1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
       1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
       2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
       3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
          a) Seal space outside of sleeve fittings with grout.
    d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
    b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
    c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
20. Verify final equipment locations for roughing-in.
21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

C. Piping Joint Construction
1. Join pipe and fittings according to the following requirements and Division 28 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

D. Painting
1. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

E. Concrete Bases
1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
   c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   e. Install anchor bolts to elevations required for proper attachment to supported equipment.
   f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

F. Erection Of Metal Supports And Anchorages
1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
3. Field Welding: Comply with AWS D1.1.

G. Erection Of Wood Supports And Anchorages
1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

H. Grouting
1. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 07 63 00 00

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SECTION 07 63 00 00a - COMMON WORK RESULTS FOR PLUMBING

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Piping materials and installation instructions common to most piping systems.
b. Transition fittings.
c. Dielectric fittings.
d. Mechanical sleeve seals.
e. Sleeves.
f. Escutcheons.
g. Grout.
h. Plumbing demolition.
i. Equipment installation requirements common to equipment sections.
j. Painting and finishing.
k. Concrete bases.
l. Supports and anchorages.

C. Definitions
1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
a. ABS: Acrylonitrile-butadiene-styrene plastic.
b. CPVC: Chlorinated polyvinyl chloride plastic.
c. PE: Polyethylene plastic.
d. PVC: Polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
a. EPDM: Ethylene-propylene-diene terpolymer rubber.
b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals
1. Welding certificates.

E. Quality Assurance
1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling
1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings
1. Refer to individual Division 14 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials
1. Refer to individual Division 14 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
      1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining Plastic Piping:
   a. ABS Piping: ASTM D 2235.
   b. CPVC Piping: ASTM F 493.
   c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   d. PVC to ABS Piping Transition: ASTM D 3138.
9. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

C. Transition Fittings
1. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   a. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.

b. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
c. Aboveground Pressure Piping: Pipe fitting.

2. Plastic-to-Metal Transition Fittings: CPVC **OR** PVC, **as directed**, one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
3. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
4. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC **OR** PVC, **as directed**, four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
5. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

D. Dielectric Fittings
1. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
5. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   a. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
7. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

E. Mechanical Sleeve Seals
1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
   c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

F. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set screws.
5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.

7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

G. Escutcheons
1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
   a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

H. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
   c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Plumbing Demolition
1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

B. Piping Systems - Common Requirements
1. Install piping according to the following requirements and Division 14 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
    a. New Piping:
        1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
        2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
        3) Insulated Piping: One-piece, stamped-steel type with spring clips.
        4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
            a) One-piece, cast-brass type with polished chrome-plated finish.
            OR
            One-piece, stamped-steel type.
        5) Bare Piping at Ceiling Penetrations in Finished Spaces:
            a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
            OR
            One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
        6) Bare Piping in Unfinished Service Spaces:
            a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
            OR
            One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
        7) Bare Piping in Equipment Rooms:
            a) One-piece, cast-brass type.
            OR
            One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
        8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
    b. Existing Piping: Use the following:
        1) Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
        2) Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
        3) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
            a) Split-casting, cast-brass type with chrome-plated finish.
            OR
            Split-plate, stamped-steel type with concealed hinge and spring clips.
        4) Bare Piping at Ceiling Penetrations in Finished Spaces:
            a) Split-casting, cast-brass type with chrome-plated finish.
            OR
            Split-plate, stamped-steel type with concealed hinge and set screw.
        5) Bare Piping in Unfinished Service Spaces:
            a) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
            OR

Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.

6) Bare Piping in Equipment Rooms:
   a) Split-casting, cast-brass type.
      OR
      Split-plate, stamped-steel type with set screw or spring clips.
7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

13. Sleeves are not required for core-drilled holes.
14. Permanent sleeves are not required for holes formed by removable PE sleeves.
15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    a. Cut sleeves to length for mounting flush with both surfaces.
       1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
       1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
       2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
       3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
          a) Seal space outside of sleeve fittings with grout.
    d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
    b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
    c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
20. Verify final equipment locations for roughing-in.
21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

C. Piping Joint Construction
1. Join pipe and fittings according to the following requirements and Division 14 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   c. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   d. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   e. PVC Nonpressure Piping: Join according to ASTM D 2855.
   f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
11. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
12. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.
13. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

D. Piping Connections
1. Make connections according to the following, unless otherwise indicated:
   a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

E. Equipment Installation - Common Requirements
1. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

2. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
3. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
4. Install equipment to allow right of way for piping installed at required slope.

F. Painting
1. Painting of plumbing systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

G. Concrete Bases
1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
   c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   e. Install anchor bolts to elevations required for proper attachment to supported equipment.
   f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

H. Erection Of Metal Supports And Anchorages
1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
3. Field Welding: Comply with AWS D1.1.

I. Erection Of Wood Supports And Anchorages
1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

J. Grouting
1. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 07 63 00 00a

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SECTION 07 63 00 00b - COMMON WORK RESULTS FOR HVAC

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Piping materials and installation instructions common to most piping systems.
b. Transition fittings.
c. Dielectric fittings.
d. Mechanical sleeve seals.
e. Sleeves.
f. Escutcheons.
g. Grout.
h. HVAC demolition.
i. Equipment installation requirements common to equipment sections.
j. Painting and finishing.
k. Concrete bases.
l. Supports and anchorages.

C. Definitions
1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
a. CPVC: Chlorinated polyvinyl chloride plastic.
b. PE: Polyethylene plastic.
c. PVC: Polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
a. EPDM: Ethylene-propylene-diene terpolymer rubber.
b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals
1. Welding certificates.

E. Quality Assurance
1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

3. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling
1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings
1. Refer to individual Division 21 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials
1. Refer to individual Division 21 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining Plastic Piping:
a. CPVC Piping: ASTM F 493.
b. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
9. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

C. Transition Fittings
1. Plastic-to-Metal Transition Fittings: CPVC **OR** PVC, **as directed**, one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
2. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
3. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC **OR** PVC, **as directed**, four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

D. Dielectric Fittings
1. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
5. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   a. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
7. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

E. Mechanical Sleeve Seals
1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
   c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

F. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set screws.
5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

G. Escutcheons
1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
   a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.

5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

H. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
   c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. HVAC Demolition
1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   d. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   e. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   f. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   g. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

B. Piping Systems - Common Requirements
1. Install piping according to the following requirements and Division 21 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.

10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
    a. New Piping:
        1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
        2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
        3) Insulated Piping: One-piece, stamped-steel type with spring clips.
        4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
            a) One-piece, cast-brass type with polished chrome-plated finish.
            OR
            One-piece, stamped-steel type.
        5) Bare Piping at Ceiling Penetrations in Finished Spaces:
            a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
            OR
            One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
        6) Bare Piping in Unfinished Service Spaces:
            a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
            OR
            One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
        7) Bare Piping in Equipment Rooms:
            a) One-piece, cast-brass type.
            OR
            One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
        8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
    b. Existing Piping: Use the following:
        1) Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
        2) Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
        3) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
            a) Split-casting, cast-brass type with chrome-plated finish.
            OR
            Split-plate, stamped-steel type with concealed hinge and spring clips.
        4) Bare Piping at Ceiling Penetrations in Finished Spaces:
            a) Split-casting, cast-brass type with chrome-plated finish.
            OR
            Split-plate, stamped-steel type with concealed hinge and set screw.
        5) Bare Piping in Unfinished Service Spaces:
            a) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
            OR
            Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
        6) Bare Piping in Equipment Rooms:
            a) Split-casting, cast-brass type.
            OR
            Split-plate, stamped-steel type with set screw or spring clips.
        7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
13. Sleeves are not required for core-drilled holes.
14. Permanent sleeves are not required for holes formed by removable PE sleeves.

15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    a. Cut sleeves to length for mounting flush with both surfaces.
        1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
        1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
        2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
        3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
            a) Seal space outside of sleeve fittings with grout.
    d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
    b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
    c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
20. Verify final equipment locations for roughing-in.
21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

C. Piping Joint Construction
1. Join pipe and fittings according to the following requirements and Division 21 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   d. PVC Nonpressure Piping: Join according to ASTM D 2855.
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
11. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
12. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.
13. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

D. Piping Connections
1. Make connections according to the following, unless otherwise indicated:
   a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

E. Equipment Installation - Common Requirements
1. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
2. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
3. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
4. Install equipment to allow right of way for piping installed at required slope.

F. Painting
1. Painting of HVAC systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

G. Concrete Bases
1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
   c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   e. Install anchor bolts to elevations required for proper attachment to supported equipment.
   f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

H. Erection Of Metal Supports And Anchorages
1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
3. Field Welding: Comply with AWS D1.1.

I. Erection Of Wood Supports And Anchorages
1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

J. Grouting
1. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 07 63 00 00b

Task	Specification	Specification Description
07 63 00 00	04 05 23 16	Sheet Metal Flashing And Trim
07 65 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 65 16 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 65 16 00	07 53 16 00	EPDM Membrane Roofing
07 65 16 00	07 56 00 00	Coated Foamed Roofing
07 71 13 00	04 05 23 16	Sheet Metal Flashing And Trim

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SECTION 07 71 23 00 - MANUFACTURED ROOF SPECIALTIES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for manufactured roof specialties. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Copings.
   b. Roof-edge flashings.
   c. Roof-edge drainage systems.
   d. Reglets and counterflashings.

C. Performance Requirements
1. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
2. FM Approvals' Listing (if Project is FM Global insured or if FM Approvals' requirements set a minimum quality standard): Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-60 **OR** Class 1-75 **OR** Class 1-90 **OR** Class 1-105 **OR** Class 1-120, **as directed**. Identify materials with FM Approvals' markings.
3. SPRI Wind Design Standard (if Project is governed by the IBC or if SPRI ES-1 sets a minimum quality standard): Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
   a. Design Pressure: As indicated on Drawings **OR** As directed.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
   a. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
   b. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
   c. Details of termination points and assemblies, including fixed points.
   d. Details of special conditions.
3. Samples: For copings **OR** roof-edge flashings **OR** roof-edge drainage systems **OR** reglets and counterflashings, **as directed**, made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.
4. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

5. Maintenance Data: For roofing specialties to include in maintenance manuals.
6. Warranty: Sample of special warranty.

E. Quality Assurance
1. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
2. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

G. Warranty
1. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   a. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   b. Finish Warranty Period: 20 **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Exposed Metals
1. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
   a. Non-Patinated Exposed Finish: Mill.
   b. Pre-Patinated Copper-Sheet Finish: Pre-patinated according to ASTM B 882.
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
   a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   b. Mill Finish: As manufactured.
   c. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      1) Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
      2) Three-Coat Fluoropolymer: AAMA 620. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
      3) Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
   d. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
   e. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
3. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
   a. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Two-Coat Fluoropolymer: AAMA 2604 **OR** AAMA 2605, **as directed**. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
2) Three-Coat Fluoropolymer: AAMA 2605. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.

b. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
c. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

4. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
5. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
   a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
   b. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
   c. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      1) Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
      2) Three-Coat Fluoropolymer: AAMA 621. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.

B. Concealed Metals
1. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
3. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
4. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

C. Underlayment Materials
1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   a. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
   b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
4. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

D. Miscellaneous Materials
1. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
2. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
   a. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
   b. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
   c. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
   d. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

e. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** silicone, **as directed**, polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
4. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
5. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
6. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
7. Solder for Copper: ASTM B 32, lead-free solder **OR** Grade Sn50, 50 percent tin and 50 percent lead, **as directed**.

E. Copings

1. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
   a. Coping-Cap Material: Copper, 20 oz./sq. ft. (0.68 mm thick) **OR** weight (thickness) as required to meet performance requirements, **as directed**.
      1) Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.

      OR

      Coping-Cap Material: Formed **OR** Extruded, **as directed**, aluminum, 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** 0.063 inch (1.60 mm) thick **OR** 0.080 inch (2.03 mm) thick **OR** 0.125 inch (3.18 mm) thick **OR** thickness as required to meet performance requirements, **as directed**.
      1) Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
      2) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

      OR

      Coping-Cap Material: Zinc-coated steel, nominal 0.028-inch (0.71-mm) thickness **OR** 0.034-inch (0.86-mm) thickness **OR** thickness as required to meet performance requirements, **as directed**.
      1) Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
      2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
   c. Special Fabrications: Radiussed sections **OR** Arched sections **OR** Bullnose face leg **OR** Two-way sloped coping cap, **as directed**.
   d. Coping-Cap Attachment Method: Snap-on **OR** Face leg hooked to continuous cleat with back leg fastener exposed, **as directed**, fabricated from coping-cap material.
   e. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.

      OR

      Face Leg Cleats: Concealed, continuous galvanized-steel sheet **OR** stainless steel, **as directed**.

F. Roof-Edge Flashings

1. Canted Roof-Edge and Fascia **OR** Fascia and Gravel Stop, **as directed**: Manufactured, two-piece, roof-edge fascia consisting of snap-on **OR** compression-clamped, **as directed**, metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed

galvanized-steel sheet cant, 0.028 inch (0.71 mm) thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

a. Fascia Cover: Fabricated from the following exposed metal:
   1) Formed Aluminum: 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** 0.063 inch (1.60 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
   2) Extruded Aluminum: 0.080 inch (2.03 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
   3) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness **OR** 0.034-inch (0.86-mm) thickness **OR** thickness as required to meet performance requirements, **as directed**.

b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.

c. Splice Plates: Concealed **OR** Exposed, **as directed**, of same material, finish, and shape as fascia cover.

d. Special Fabrications: Radiussed sections **OR** Arched sections **OR** Bullnose fascia cover **OR** Cornice fascia cover **OR** Cove fascia cover, **as directed**.

e. Fascia Accessories: Fascia extenders with continuous hold-down cleats **OR** Wall cap **OR** Soffit trim **OR** Overflow scuppers **OR** Overflow scuppers with perforated screens **OR** Spillout scuppers **OR** Downspout scuppers with integral conductor head and downspout adapters **OR** Downspout scuppers with integral conductor head and downspout adapters and perforated screens, **as directed**.

2. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.

a. Fascia Cover: Fabricated from the following exposed metal:
   1) Formed Aluminum: 0.032 inch (0.81 mm) thick **OR** 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** 0.063 inch (1.60 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
   2) Zinc-Coated Steel: Nominal 0.028 inch (0.71 mm) thick **OR** 0.034 inch (0.86 mm) thick **OR** thickness as required to meet performance requirements, **as directed**.

b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.

c. Splice Plates: Concealed **OR** Exposed, **as directed**, of same material, finish, and shape as fascia cover.

d. Special Fabrications: Radiussed sections **OR** Arched sections **OR** Bullnose fascia cover **OR** Cornice fascia cover **OR** Cove fascia cover, **as directed**.

e. Fascia Accessories: Fascia extenders with continuous hold-down cleats **OR** Wall cap **OR** Soffit trim **OR** Overflow scuppers **OR** Overflow scuppers with perforated screens **OR** Spillout scuppers **OR** Downspout scuppers with integral conductor head and downspout adapters **OR** Downspout scuppers with integral conductor head and downspout adapters and perforated screens, **as directed**.

3. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet (3.6 m), with a horizontal flange and vertical leg, drain-through, **as directed**, fascia terminating in a drip edge, **as directed**, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.

a. Fabricate from the following exposed metal:
   1) Copper: 16 oz./sq. ft. (0.55 mm thick) **OR** Weight (thickness) as required to meet performance requirements, **as directed**.
   2) Formed Aluminum: 0.032 inch (0.81 mm) thick **OR** 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
   3) Extruded Aluminum: 0.080 inch (2.03 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.

4) Stainless Steel: 0.025 inch (0.64 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
5) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness **OR** 0.034-inch (0.86-mm) thickness **OR** thickness as required to meet performance requirements, **as directed**.

b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
c. Accessories: Fascia extenders with continuous hold-down cleats **OR** Wall cap **OR** Soffit trim, **as directed**.

4. Copper Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
5. Aluminum Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 3 (coarse, polished directional satin) **OR** No. 4 (bright, polished directional satin), **as directed**.
7. Zinc-Coated Steel Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

G. Roof-Edge Drainage Systems
1. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
a. Fabricate from the following exposed metal:
1) Copper: 16 oz./sq. ft. (0.55 mm thick) **OR** 20 oz./sq. ft. (0.68 mm thick), **as directed**.
2) Formed Aluminum: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
3) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, thickness.
b. Gutter Profile: Style A **OR** Style B **OR** Style F **OR** Style G **OR** Style H **OR** Style I **OR** Style K **OR** Style K highback **OR** Half-round single bead **OR** Half-round highback **OR** Quarter round **OR** Ogee **OR** As indicated, **as directed**, according to SMACNA's "Architectural Sheet Metal Manual."
c. Embossed Surface: Embossed with design as indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
d. Applied Fascia Cover (Concealed Gutter): Exposed, formed copper, 16 oz./sq. ft. (0.55 mm thick) **OR** aluminum, 0.040 inch (1.02 mm) thick, **as directed**, with factory-mitered corners, ends, and concealed splice joints.
e. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
f. Gutter Supports: Gutter brackets **OR** Straps **OR** Spikes and ferrules **OR** Manufacturer's standard supports as selected by the Owner, **as directed**, with finish matching the gutters.
g. Special Fabrications: Radiussed sections.
h. Gutter Accessories: Continuous screened leaf guard with sheet metal frame **OR** Continuous hinged leaf guard of solid metal designed to shed leaves **OR** Continuous snap-in plastic leaf guard **OR** Bronze wire ball downspout strainer **OR** Wire ball downspout strainer **OR** Flat ends **OR** Bullnose ends for half-round gutter, **as directed**.
2. Downspouts: Plain round **OR** Corrugated round **OR** Plain rectangular **OR** Corrugated rectangular **OR** Open-face rectangular, **as directed**, complete with machine-crimped **OR** mitered **OR**

smooth-curve, **as directed**, elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
a. Copper: 16 oz./sq. ft. (0.55 mm thick).
b. Formed Aluminum: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
c. Extruded Aluminum: 0.125 inch (3.18 mm) thick.
d. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, thickness.

3. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scuppers, **as directed**.
a. Fabricate from the following exposed metal:
1) Copper: 16 oz./sq. ft. (0.55 mm thick).
2) Formed Aluminum: 0.032 inch (0.81 mm) thick.
3) Stainless Steel: 0.019 inch (0.48 mm) thick.
4) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

4. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, **as directed**, and built-in overflow, **as directed**.
a. Fabricate from the following exposed metal:
1) Copper: 16 oz./sq. ft. (0.55 mm thick).
2) Formed Aluminum: 0.032 inch (0.81 mm) thick.
3) Stainless Steel: 0.016 inch (0.40 mm) thick.
4) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

5. Splash Pans: Fabricate from the following exposed metal:
a. Copper: 16 oz./sq. ft. (0.55 mm thick).
b. Formed Aluminum: 0.040 inch (1.02 mm) thick.
c. Stainless Steel: 0.019 inch (0.48 mm) thick.
d. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

6. Copper Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.

7. Aluminum Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full rang, **as directed**.

8. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished) **OR** No. 3 (coarse, polished directional satin) **OR** No. 4 (bright, polished directional satin), **as directed**.

9. Zinc-Coated Steel Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

H. Reglets And Counterflashings
1. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
a. Copper: 16 oz./sq. ft. (0.55 mm thick).
b. Formed Aluminum: 0.024 inch (0.61 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
c. Stainless Steel: 0.019 inch (0.48 mm) **OR** 0.025 inch (0.64 mm), **as directed**, thick.
d. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm), **as directed**, thickness.
e. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
f. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

g. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
h. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
i. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
j. Multiuse Type, Embedded: For multiuse embedment in cast-in-place concrete **OR** masonry mortar joints, **as directed**.

2. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
   a. Copper: 16 oz./sq. ft. (0.55 mm thick).
   b. Formed Aluminum: 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
   c. Stainless Steel: 0.019 inch (0.48 mm) **OR** 0.025 inch (0.64 mm), **as directed**, thick.
   d. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm), **as directed**, thickness.
3. Accessories:
   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
4. Copper Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
5. Aluminum Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished) **OR** No. 3 (coarse, polished directional satin) **OR** No. 4 (bright, polished directional satin), **as directed**.
7. Zinc-Coated Steel Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
   a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

I. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Examination
1. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
2. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
3. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Underlayment Installation
1. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
2. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
3. Polyethylene Sheet: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
4. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

C. Installation, General
1. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
   a. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   b. Provide uniform, neat seams with minimum exposure of solder and sealant.
   c. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
   d. Torch cutting of roof specialties is not permitted.
   e. Do not use graphite pencils to mark metal surfaces.
2. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   a. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   b. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet **OR** self-adhering, high-temperature sheet underlayment **OR** polyethylene sheet, **as directed**.
   c. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
3. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
   a. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise shown on Drawings.
   b. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
4. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws **OR** substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, **as directed**.
5. Seal joints with elastomeric **OR** butyl, **as directed**, sealant as required by roofing-specialty manufacturer.
6. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).
7. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow

solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

D. Coping Installation
1. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
2. Anchor copings to meet performance requirements.
   a. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch (760-mm) centers **OR** 40-inch (1015-mm) centers **OR** manufacturer's required spacing that meets performance requirements, **as directed**.
   b. Interlock face leg drip edge into continuous cleat anchored to substrate at 24-inch (600-mm) centers **OR** 16-inch (400-mm) centers **OR** manufacturer's required spacing that meets performance requirements, **as directed**. Anchor back leg of coping with screw fasteners and elastomeric washers at 24-inch (600-mm) centers **OR** 16-inch (400-mm) centers **OR** manufacturer's required spacing that meets performance requirements, **as directed**.

E. Roof-Edge Flashing Installation
1. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
2. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

F. Roof-Edge Drainage-System Installation
1. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
2. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches (305 mm) **OR** 24 inches (610 mm) **OR** 30 inches (762 mm), **as directed**, apart. Attach ends with rivets and seal with sealant **OR** solder, **as directed**, to make watertight. Slope to downspouts.
   a. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion joint caps.
   b. Install continuous leaf guards on gutters with noncorrosive fasteners, removable **OR** hinged to swing open, **as directed**, for cleaning gutters.
3. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
   a. Provide elbows at base of downspout to direct water away from building.
      OR
      Connect downspouts to underground drainage system indicated.
4. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement **OR** elastomeric sealant, **as directed**.
5. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   a. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
   b. Loosely lock front edge of scupper with conductor head.
   c. Seal or solder exterior wall scupper flanges into back of conductor head.
6. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch (25 mm) below scupper **OR** gutter, **as directed**, discharge.

G. Reglet And Counterflashing Installation
1. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

2. Embedded Reglets: See Division 03 Section "Cast-in-place Concrete" and Division 04 Section "Unit Masonry" for installation of reglets.
3. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.
4. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric **OR** butyl, **as directed**, sealant. Fit counterflashings tightly to base flashings.

H. Cleaning And Protection
1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
2. Clean and neutralize flux materials. Clean off excess solder and sealants.
3. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
4. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 23 00

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Task	Specification	Specification Description
07 71 23 00	01 22 16 00	No Specification Required
07 71 23 00	05 73 23 00	Miscellaneous Ornamental Metals
07 71 23 00	04 05 23 16	Sheet Metal Flashing And Trim
07 71 26 00	04 05 23 16	Sheet Metal Flashing And Trim

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SECTION 07 72 13 00 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for packaged, outdoor, central-station air-handling units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
   a. Direct-expansion cooling.
   b. Heat-pump refrigeration components.
   c. Hot-gas reheat.
   d. Electric-heating coils.
   e. Gas furnace.
   f. Economizer outdoor- and return-air damper section.
   g. Integral, space temperature controls.
   h. Roof curbs.

C. Definitions
1. DDC: Direct-digital controls.
2. ECM: Electrically commutated motor.
3. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
4. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
5. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
6. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
7. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
8. VVT: Variable-air volume and temperature.

D. Performance Requirements
1. Delegated Design: Design RTU supports to comply with wind and seismic, **as directed**, performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Wind-Restraint Performance:
   a. Basic Wind Speed: <**Insert value**>.
   b. Building Classification Category: I **OR** II **OR** III **OR** IV, **as directed**.
   c. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
3. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals
1. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
2. LEED Submittals:
   a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
   b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   a. Wiring Diagrams: Power, signal, and control wiring.
4. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
   b. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
   c. Wind- and Seismic-Restraint Details, **as directed**: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
5. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
7. Field quality-control test reports.
8. Operation and maintenance data.
9. Warranty: Special warranty specified in this Section.

F. Quality Assurance
1. ARI Compliance:
   a. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
   b. Comply with ARI 270 for testing and rating sound performance for RTUs.
2. ASHRAE Compliance:
   a. Comply with ASHRAE 15 for refrigeration system safety.
   b. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

c. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
5. UL Compliance: Comply with UL 1995.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
   a. Warranty Period for Compressors: Manufacturer's standard, but not less than five **OR** 10, **as directed**, years from date of Final Completion.
   b. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five **OR** 10 **OR** 15 **OR** 20, **as directed**, years from date of Final Completion.
   c. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Final Completion.
   d. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Final Completion.

1.2 PRODUCTS

A. Casing

1. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
2. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
   a. Exterior Casing Thickness: 0.052 inch (1.3 mm) **OR** 0.0626 inch (1.6 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
3. Inner Casing Fabrication Requirements:
   a. Inside Casing: Galvanized steel, 0.034 inch (0.86 mm) **OR** 0.028 inch (0.7 mm), **as directed**, thick, perforated 40 percent free area, **as directed**.
4. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
   a. Materials: ASTM C 1071, Type I.
   b. Thickness: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**.
   c. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
   d. Liner Adhesive: Comply with ASTM C 916, Type I.
5. Condensate Drain Pans: Formed sections of galvanized-steel **OR** stainless-steel, **as directed**, sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.1, **as directed**.
   a. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
   b. Drain Connections: Threaded nipple both sides of drain pan, **as directed**.
   c. Pan-Top Surface Coating: Corrosion-resistant compound for galvanized-steel drain pans.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fans

1. Direct-Driven Supply-Air Fans: Double width, forward curved **OR** backward inclined, **as directed**, centrifugal; with permanently lubricated, multispeed **OR** ECM, **as directed**, motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

OR

Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

2. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
3. Relief-Air Fan: Propeller **OR** Forward curved **OR** Backward inclined, **as directed**, shaft mounted on permanently lubricated motor.
4. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.
5. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

C. Coils

1. Supply-Air Refrigerant Coil:
   a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
   b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
   c. Coil Split: Interlaced.
   d. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
   e. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, formed with pitch and drain connections complying with ASHRAE 62.1, **as directed**.
2. Outdoor-Air Refrigerant Coil:
   a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
   b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
   c. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
3. Hot-Gas Reheat Refrigerant Coil:
   a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
   b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
   c. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
4. Electric-Resistance Heating:
   a. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
   b. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
   c. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
   d. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
      1) Magnetic **OR** Mercury, **as directed**, contactors.
      2) Step Controller: Pilot lights and override toggle switch for each step.
      3) SCR Controller: Pilot lights operate on load ratio, a minimum of five steps.
      4) Time-delay relay.
      5) Airflow proving switch.

D. Refrigerant Circuit Components
1. Number of Refrigerant Circuits: One **OR** Two, **as directed**.
2. Compressor: Hermetic, reciprocating **OR** Semihermetic, reciprocating **OR** Hermetic, scroll, **as directed**, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater, **as directed**.
3. Refrigeration Specialties:
   a. Refrigerant: R-407C **OR** R-410A, **as directed**.
   b. Expansion valve with replaceable thermostatic element.
   c. Refrigerant filter/dryer.
   d. Manual-reset high-pressure safety switch.
   e. Automatic-reset low-pressure safety switch.
   f. Minimum off-time relay.
   g. Automatic-reset compressor motor thermal overload.
   h. Brass service valves installed in compressor suction and liquid lines.
   i. Low-ambient kit high-pressure sensor.
   j. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
   k. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
   l. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

E. Air Filtration
1. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
   a. Glass Fiber: Minimum 80 percent arrestance, and MERV 5.
   b. Pleated: Minimum 90 percent arrestance, and MERV 7.

F. Gas Furnace
1. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
   a. CSA Approval: Designed and certified by and bearing label of CSA.
2. Burners: Stainless steel.
   a. Fuel: Natural **OR** Propane, **as directed**, gas.
   b. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
   c. High-Altitude Model **OR** Kit, **as directed**: For Project elevations more than 2000 feet (610 m) above sea level.
3. Heat-Exchanger and Drain Pan: Stainless steel.
4. Venting: Gravity vented with vertical extension, **as directed**.
   OR
   Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension, **as directed**.
5. Safety Controls:
   a. Gas Control Valve: Single stage **OR** Two stage **OR** Modulating, **as directed**.
   b. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

G. Dampers
1. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with manual **OR** motorized, **as directed**, damper filter.
2. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
   a. Damper Motor: Modulating with adjustable minimum position.
   b. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

H. Electrical Power Connection

1. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit, **as directed**, and control-circuit transformer with built-in overcurrent protection.

I. Controls
   1. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation And Control For Hvac".
   2. Basic Unit Controls:
      a. Control-voltage transformer.
      b. Wall-mounted thermostat or sensor with the following features:
         1) Heat-cool-off switch.
         2) Fan on-auto switch.
         3) Fan-speed switch.
         4) Manual **OR** Automatic, **as directed**, changeover.
         5) Adjustable deadband.
         6) Concealed **OR** Exposed, **as directed**, set point.
         7) Concealed **OR** Exposed, **as directed**, indication.
         8) Degree F **OR** Degree C, **as directed**, indication.
         9) Unoccupied-period-override push button.
         10) Data entry and access port to input temperature and humidity, **as directed**, set points, occupied and unoccupied periods, and output room temperature and humidity, **as directed**, supply-air temperature, operating mode, and status.
      c. Wall-mounted humidistat or sensor with the following features:
         1) Concealed **OR** Exposed, **as directed**, set point.
         2) Concealed **OR** Exposed, **as directed**, indication.
      d. Remote Wall **OR** Unit, **as directed**,-Mounted Annunciator Panel for Each Unit:
         1) Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
         2) DDC controller or programmable timer and interface with HVAC instrumentation and control system.
         3) Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
   3. Electronic **OR** DDC, **as directed**, Controller:
      a. Controller shall have volatile-memory backup.
      b. Safety Control Operation:
         1) Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
         2) Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F (54 deg C) enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
         3) Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System", **as directed.**
         4) Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F (4 deg C).
         5) Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
      c. Scheduled Operation: Occupied and unoccupied periods on seven-day **OR** 365-day, **as directed**, clock with a minimum of two **OR** four, **as directed**, programmable periods per day.
      d. Unoccupied Period:
         1) Heating Setback: 10 deg F (5.6 deg C).
         2) Cooling Setback: System off.
         3) Override Operation: Two hours.
      e. Supply Fan Operation:

1) Occupied Periods: Run fan continuously.
2) Unoccupied Periods: Cycle fan to maintain setback temperature.

f. Refrigerant Circuit Operation:
1) Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass, **as directed**, to match compressor output to cooling load to maintain room **OR** discharge, **as directed**, temperature and humidity, **as directed**. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
2) Unoccupied Periods: Compressors off **OR** Cycle compressors and condenser fans for heating to maintain setback temperature, **as directed**.
3) Switch reversing valve for heating or cooling mode on air-to-air heat pump.

g. Hot-Gas Reheat-Coil Operation:
1) Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
2) Unoccupied Periods: Reheat not required.

h. Gas Furnace Operation:
1) Occupied Periods: Cycle **OR** Stage **OR** Modulate, **as directed**, burner to maintain room **OR** discharge, **as directed**, temperature.
2) Unoccupied Periods: Cycle burner to maintain setback temperature.

i. Electric-Heating-Coil Operation:
1) Occupied Periods: Cycle **OR** Stage **OR** Modulate, **as directed**, coil to maintain room **OR** discharge, **as directed**, temperature.
2) Unoccupied Periods: Energize coil to maintain setback temperature.
3) Operate supplemental electric heating coil with compressor for heating with outdoor temperature below 25 deg F (minus 4 deg C).

j. Fixed Minimum Outdoor-Air Damper Operation:
1) Occupied Periods: Open to 25 percent.
2) Unoccupied Periods: Close the outdoor-air damper.

k. Economizer Outdoor-Air Damper Operation:
1) Occupied Periods: Open to 10 **OR** 25, **as directed**, percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F (15 deg C). Use outdoor-air temperature **OR** mixed-air and outdoor-air temperature **OR** outdoor-air enthalpy **OR** mixed-air temperature and select between outdoor-air and return-air enthalpy, **as directed**, to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper, **as directed**. During economizer cycle operation, lock out cooling.
2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
3) Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 2- to 10-V dc **OR** 4 to 20 mA, **as directed**.

l. Carbon Dioxide Sensor Operation:
1) Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.

m. VVT Relays:
1) Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system required in Division 23 Section(s) "Air Terminal Units" AND "Instrumentation And Control For Hvac".

4. Interface Requirements for HVAC Instrumentation and Control System:
a. Interface relay for scheduled operation.
b. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
c. Provide BACnet **OR** LonWorks, **as directed**, compatible interface for central HVAC control workstation for the following:
1) Adjusting set points.

2) Monitoring supply fan start, stop, and operation.
3) Inquiring data to include outdoor-air damper position, **as directed**, supply- and room-air temperature and humidity, **as directed**.
4) Monitoring occupied and unoccupied operations.
5) Monitoring constant and variable motor loads.
6) Monitoring variable-frequency drive operation.
7) Monitoring cooling load.
8) Monitoring economizer cycles.
9) Monitoring air-distribution static pressure and ventilation air volume.

J. Accessories
1. Electric heater with integral thermostat maintains minimum 50 deg F (10 deg C) temperature in gas burner compartment.
2. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open, **as directed**.
3. Low-ambient kit using staged **OR** damper on **OR** variable-speed, **as directed**, condenser fans for operation down to 35 deg F (1.7 deg C).
4. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
5. Coil guards of painted, galvanized-steel wire.
6. Hail guards of galvanized steel, painted to match casing.
7. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

K. Roof Curbs
1. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
a. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1) Materials: ASTM C 1071, Type I or II.
2) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.
b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
1) Liner Adhesive: Comply with ASTM C 916, Type I.
2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
4) Liner Adhesive: Comply with ASTM C 916, Type I.
2. Curb Height: 14 inches (355 mm) **OR** 24 inches (610 mm) **OR** 36 inches (910 mm), **as directed**.
3. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for wind-load requirements.

1.3 EXECUTION

A. Installation

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger than supported equipment and minimum 6 inches (150 mm) above finished ground elevation.
   b. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   c. Install anchor bolts to elevations required for proper attachment to supported equipment.
   d. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   e. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
2. Equipment Mounting: Install RTUs on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
   a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.

   OR

   Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" **OR** ARI Guideline B, **as directed**. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories". Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
3. Unit Support: Install unit level on structural curbs **OR** pilings, **as directed**. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
4. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

B. Connections
1. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
2. Install piping adjacent to RTUs to allow service and maintenance.
   a. Gas Piping: Comply with applicable requirements in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
3. Duct installation requirements are specified in other Division 21. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
   a. Install ducts to termination at top of roof curb.
   b. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
   c. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories".
   d. Install return-air duct continuously through roof structure.
   e. Install normal-weight, 3000-psi (20.7-MPa), compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm) thick. Concrete, formwork, and reinforcement are specified in Division 31.

C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:
   a. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
   b. Inspect for and remove shipping bolts, blocks, and tie-down straps.

c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Remove and replace malfunctioning units and retest as specified above.

D. Startup Service
1. Engage a factory-authorized service representative to perform startup service.
2. Complete installation and startup checks according to manufacturer's written instructions and do the following:
a. Inspect for visible damage to unit casing.
b. Inspect for visible damage to furnace combustion chamber.
c. Inspect for visible damage to compressor, coils, and fans.
d. Inspect internal insulation.
e. Verify that labels are clearly visible.
f. Verify that clearances have been provided for servicing.
g. Verify that controls are connected and operable.
h. Verify that filters are installed.
i. Clean condenser coil and inspect for construction debris.
j. Clean furnace flue and inspect for construction debris.
k. Connect and purge gas line.
l. Remove packing from vibration isolators.
m. Inspect operation of barometric relief dampers.
n. Verify lubrication on fan and motor bearings.
o. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
p. Adjust fan belts to proper alignment and tension.
q. Start unit according to manufacturer's written instructions.
1) Start refrigeration system.
2) Do not operate below recommended low-ambient temperature.
3) Complete startup sheets and attach copy with Contractor's startup report.
r. Inspect and record performance of interlocks and protective devices; verify sequences.
s. Operate unit for an initial period as recommended or required by manufacturer.
t. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
1) Measure gas pressure on manifold.
2) Inspect operation of power vents.
3) Measure combustion-air temperature at inlet to combustion chamber.
4) Measure flue-gas temperature at furnace discharge.
5) Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
6) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
u. Calibrate thermostats.
v. Adjust and inspect high-temperature limits.
w. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
x. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
1) Coil leaving-air, dry- and wet-bulb temperatures.
2) Coil entering-air, dry- and wet-bulb temperatures.
3) Outdoor-air, dry-bulb temperature.
4) Outdoor-air-coil, discharge-air, dry-bulb temperature.
y. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
z. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

1) Supply-air volume.
2) Return-air volume.
3) Relief-air volume.
4) Outdoor-air intake volume.

aa. Simulate maximum cooling demand and inspect the following:
1) Compressor refrigerant suction and hot-gas pressures.
2) Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

bb. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
1) High-temperature limit on gas-fired heat exchanger.
2) Low-temperature safety operation.
3) Filter high-pressure differential alarm.
4) Economizer to minimum outdoor-air changeover.
5) Relief-air fan operation.
6) Smoke and firestat alarms.

cc. After startup and performance testing and prior to Final Completion, replace existing filters with new filters.

E. Cleaning And Adjusting
1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
2. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

F. Demonstration

G. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 07 72 13 00

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SECTION 07 72 13 00a - INTAKE AND RELIEF VENTILATORS

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Louvered-penthouse ventilators.
b. Roof hoods.
c. Goosenecks.

C. Performance Requirements
1. Delegated Design: Design ventilators, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
2. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
a. Wind Loads: Determine loads based on pressures as indicated on Drawings.
OR
Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** 30 lbf/sq. ft. (1440 Pa), **as directed**, acting inward or outward.
OR
Wind Loads: Determine loads based on pressures indicated below:
1) Corner Zone: Within <**Insert distance**> of building corners, uniform pressure of <**Insert design wind pressure**>, acting inward, and <**Insert design wind pressure**>, acting outward.
2) Other Than Corner Zone: Uniform pressure of <**Insert design wind pressure**>, acting inward, and <**Insert design wind pressure**>, acting outward.
3. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

D. Submittals
1. Product Data: For each type of product indicated. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
2. LEED Submittal:

a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62., Section 5 - "Systems and Equipment."

3. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
   a. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
4. Samples: For each exposed product and for each color and texture specified.
5. Delegated-Design Submittal: For shop-fabricated ventilators indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   a. Detail fabrication and assembly of shop-fabricated ventilators.
6. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   a. Structural members to which roof curbs and ventilators will be attached.
   b. Sizes and locations of roof openings.
7. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
8. Welding certificates.

E. Quality Assurance
1. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   b. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Coordination
1. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.2 PRODUCTS

A. Materials
1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
3. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
4. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 **OR** 6, **as directed**, finish.
5. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
   a. Use types and sizes to suit unit installation conditions.
   b. Use Phillips flat **OR** hex-head or Phillips pan, **as directed**,-head screws for exposed fasteners unless otherwise indicated.
6. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
7. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

B. Fabrication, General
1. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
2. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
3. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
4. Fabricate supports, anchorages, and accessories required for complete assembly.
5. Perform shop welding by AWS-certified procedures and personnel.

C. Louvered-Penthouse Ventilators
1. Construction: All-welded assembly with 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed**,-deep louvers, mitered corners, and aluminum **OR** galvanized-steel **OR** stainless-steel, **as directed**, sheet roof with mineral-fiber insulation and vapor barrier, **as directed**.
2. Frame and Blade Material and Nominal Thickness: Extruded aluminum, of thickness required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm) for frames and 0.080 inch (2.0 mm) **OR** 0.060 inch (1.5 mm), **as directed**, for blades with condensate deflectors, **as directed**.
   a. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
   b. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** mitered blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
3. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.052 inch (1.3 mm) for frames and 0.040 inch (1.0 mm) **OR** 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm), **as directed**, for blades with condensate deflectors, **as directed**.
   a. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
   b. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** mitered blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
4. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.57 mm), **as directed**, with grain running parallel **OR** perpendicular, **as directed**, to length of blades and frame members with condensate deflectors, **as directed**.
   a. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
   b. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** mitered blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
5. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.
   a. Configuration: Self-flashing without a cant strip, with **OR** Built-in cant and **OR** Built-in raised cant and, **as directed**, mounting flange.
   b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
6. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire **OR** Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire **OR** Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick **OR** Stainless-steel, 1/2-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire, **as directed**.
   OR
   Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) **OR** Stainless-steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm), **as directed**, wire.
7. Galvanized-Steel Sheet Finish:
   a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to

ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

b. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.

c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).

1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

8. Accessories:

a. Dampers:

1) Location: Penthouse neck **OR** Inside louver face, **as directed**.

2) Control: Manual **OR** Motorized, **as directed**.

D. Roof Hoods

1. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.

2. Materials: Galvanized-steel sheet, minimum 0.064-inch- (1.62-mm-) thick base and 0.040-inch- (1.0-mm-) thick hood **OR** Aluminum sheet, minimum 0.063-inch- (1.6-mm-) thick base and 0.050-inch- (1.27-mm-) thick hood, **as directed**; suitably reinforced.

3. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.

a. Configuration: Self-flashing without a cant strip, with **OR** Built-in cant and **OR** Built-in raised cant and, **as directed**, mounting flange.

b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.

4. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire **OR** Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire **OR** Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick **OR** Stainless-steel, 1/2-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire, **as directed**.

OR

Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) **OR** Stainless-steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm), **as directed**, wire.

5. Galvanized-Steel Sheet Finish:

a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

b. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.

c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).

1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

E. Goosenecks

1. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch- (1.3-mm-) thick, galvanized-steel sheet.

2. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.

a. Configuration: Self-flashing without a cant strip, with **OR** Built-in cant and **OR** Built-in raised cant and, **as directed**, mounting flange.
b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.

3. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire **OR** Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire **OR** Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick **OR** Stainless-steel, 1/2-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire, **as directed**.
OR
Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) **OR** Stainless-steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm), **as directed**, wire.
4. Galvanized-Steel Sheet Finish:
a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
b. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).
1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
2. Install goosenecks on curb base where throat size exceeds 9 by 9 inches (230 by 230 mm).
3. Install gravity ventilators with clearances for service and maintenance.
4. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
5. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.
6. Label gravity ventilators according to requirements specified in Division 23 Section "Identification For Hvac Piping And Equipment".
7. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
8. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

B. Connections

1. Duct installation and connection requirements are specified in other Division 21. Drawings indicate general arrangement of ducts and duct accessories.

C. Adjusting

1. Adjust damper linkages for proper damper operation.

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SECTION 07 72 23 00 - ROOF ACCESSORIES

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Roof curbs.
b. Equipment supports.
c. Roof hatches.
d. Dropout-type heat and smoke vents.
e. Hatch-type heat and smoke vents.
f. Gravity ventilators.
g. Roof supports.
h. Roof walkways.
i. Preformed flashings.

C. Submittals
1. Product Data: For each type of roof accessory indicated.
2. Shop Drawings: Show fabrication and installation details for roof accessories.
3. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

D. Quality Assurance
1. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

E. Delivery, Storage, And Handling
1. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

F. Warranty
1. Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within 20 years from date of Final Completion.

1.2 PRODUCTS

A. Metal Materials
1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated and mill phosphatized for field painting.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
3. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
a. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 (Class AZM150) coated.

c. Exposed Finishes: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.

4. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and mill finish. Coil-coat finish as follows:
   a. Factory-Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
   b. Clear **OR** Color, **as directed**, Anodic Finish: Architectural Class II, complying with AAMA 611.
      1) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Champagne, **as directed**.
   c. Baked-Enamel Finish: Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
      1) Color and Gloss: As selected from manufacturer's full range.
   d. High-Performance Organic Finish: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
      1) Color and Gloss: As selected from manufacturer's full range.
   e. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish.
      1) Color and Gloss: As selected from manufacturer's full range.
5. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
6. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.
7. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
8. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
9. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
10. Galvanized Steel Pipe: ASTM A 53/A 53M.

B. Miscellaneous Materials
1. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
2. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated per UL 972 with an average impact strength of 12 to 16 ft-lbf/in. (640 to 854 J/m) of width when tested according to ASTM D 256, Method A (Izod).
3. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, 1 inch (25 mm) thick.
4. Glass-Fiber Board Insulation: ASTM C 726, 1 inch (25 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch (25 mm) thick.
6. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
7. Security Grilles: 3/4-inch- (19-mm-) diameter, ASTM A 1011/A 1011M steel bars spaced 6 inches (150 mm) o.c. in 1 direction and 12 inches (300 mm) o.c. in the other; factory primed.
   a. Factory Finish:
      1) Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
      2) Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
      3) Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric

corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

8. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
9. Polyethylene Sheet: 6-mil- (0.15-mm-) thick, polyethylene sheet complying with ASTM D 4397.
10. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
    a. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
11. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
12. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
13. Elastomeric Sealant: ASTM C 920, polyurethane **OR** polysulfide **OR** silicone, **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
14. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
15. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

C. Roof Curbs
1. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant, **OR** stepped integral metal cant raised the thickness of roof insulation, **as directed**, and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
    a. Load Requirements: As required to satisfy local code requirements.
    b. Material:
        1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.052 inch (1.32 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
        2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
        3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
    c. Finish:
        1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
        2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
    d. Liner: Same material as curb, of manufacturer's standard thickness and finish.
    e. Factory install wood nailers at tops of curbs.
    f. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
    g. Factory insulate curbs with 1-1/2-inch- (38-mm-) thick, cellulosic-fiber **OR** glass-fiber, **as directed**, board insulation.
    h. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
    i. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

D. Equipment Supports
1. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal

cant **OR** stepped integral metal cant raised the thickness of roof insulation, **as directed**, and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

a. Load Requirements: As required to satisfy local code requirements.
b. Material:
   1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.052 inch (1.32 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
   2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
   3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
c. Finish:
   1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
   2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
d. Factory-install continuous wood nailers 3-1/2 inches (90 mm) **OR** 5-1/2 inches (140 mm), **as directed**, wide at tops of equipment supports.
e. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
f. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
g. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
h. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

E. Roof Hatches

1. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated single-wall **OR** double-wall, **as directed**, curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
   a. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. (1.9-kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loads.
   b. Type and Size: Single-leaf lid, 30 by 36 inches (750 by 900 mm) **OR** 30 by 54 inches (750 by 1370 mm) **OR** 30 by 96 inches (750 by 2440 mm), **as directed**.
   c. Type and Size: Double-leaf lid, 72 by 96 inches (1830 by 2440 mm).
   d. Curb and Lid Material:
      1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.079 inch (2.0 mm) thick.
      2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
      3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
   e. Finish:
      1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
      2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
   f. Insulation: Cellulosic-fiber **OR** Glass-fiber **OR** Polyisocyanurate, **as directed**, board.
   g. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
   h. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
   i. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   j. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
   k. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height constant **OR** tapered to match slope to level tops of units, **as directed**.
   l. Hardware: Galvanized steel **OR** Stainless-steel, **as directed**, spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
      1) Provide 2-point latch on covers larger than 84 inches (2130 mm).
      2) Provide remote-control operation.

m. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
n. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation.

F. Heat And Smoke Vents
1. Dropout-Type Heat and Smoke Vents: Manufacturer's standard gravity-operated, automatic smoke and heat vents with integral double-wall insulated curbs and frame with welded or sealed mechanical corner joints, integral condensation gutter, cap flashing, and heat-sensitive dome glazing that will deform and drop out of vent opening within 5 minutes of exposure to a simulated fire represented by a time-temperature gradient that reaches an air temperature of 500 deg F (260 deg C) within 5 minutes.
a. Loads: Fabricate heat and smoke vents to withstand a minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 30-lbf/sq. ft. (1.4-kPa) uplift.
1) Dome glazing shall have a thickness capable of resisting 40-lbf/sq. ft. (1.9-kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loads.
b. Regulatory Requirements: Comply with UL 793 and NFPA 204.
c. Heat and Smoke Vent Compliance: Provide units that have been tested and UL listed **OR** FMG approved, **as directed**.
d. Integral Curb and Framing Material:
1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.079 inch (2.0 mm) thick.
2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
e. Finish:
1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
2) Finish: Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
f. Insulation: Cellulosic-fiber **OR** Glass-fiber **OR** Polyisocyanurate, **as directed**, board.
g. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
h. Fabricate integral curbs to minimum height of 12 inches (300 mm), unless otherwise indicated.
i. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curbs with height constant **OR** tapered to match slope to level tops of units, **as directed**.
j. Dome Glazing: Single **OR** Double, **as directed,** acrylic **OR** polycarbonate, **as directed**, glazing.
1) Single-Dome Color: Colorless, transparent **OR** White, translucent **OR** Gray tinted, transparent **OR** Bronze tinted, transparent, **as directed**.
2) Outer Double-Dome Color: Colorless, transparent **OR** White, translucent **OR** Gray tinted, transparent **OR** Bronze tinted, transparent, **as directed**.
3) Inner Double-Dome Color: Colorless, transparent **OR** White, translucent **OR** Gray tinted, transparent **OR** Bronze tinted, transparent, **as directed**.
2. Hatch-Type Heat and Smoke Vents: Manufacturer's standard single-leaf **OR** double-leaf, **as directed**, hatch-type heat and smoke vents with integral double-wall insulated curbs and frame, with welded or sealed mechanical corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-wall lid, continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms, UL-listed fusible links rated at 165 deg F (74 deg C) **OR** fire-suppression system **OR** smoke-detection system, **as directed**, and corrosion-resistant or hot-dip galvanized hardware including hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.
a. Loads: Fabricate heat and smoke vent to withstand a minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 30-lbf/sq. ft. (1.4-kPa) uplift.
1) When release is actuated, lid shall open against 10-lbf/sq. ft. (0.5-kPa) snow or wind load and lock in position.

b. Regulatory Requirements: UL 793 and NFPA 204.
c. Heat and Smoke Vent Compliance: Provide units that have been tested and UL listed **OR** FMG approved, **as directed**.
d. Fire Resistance of Lids: UL Class A rating.
e. Integral Curb, Framing, and Lid Material:
   1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.079 inch (2.0 mm) thick.
   2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
   3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
f. Finish:
   1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
   2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
g. Insulation: Cellulosic-fiber **OR** Glass-fiber **OR** Polyisocyanurate, **as directed**, board.
h. Fabricate integral curbs to minimum height of 12 inches (300 mm), unless otherwise indicated.
i. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curbs with height constant **OR** tapered to match slope to level tops of units, **as directed**.

G. Gravity Ventilators
1. Low-Profile, Cylindrical-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
   a. Provide integral base flange, vent cylinder, cylinder bird screen, and rain cap **OR** hood, **as directed**.
   b. Dimensions: As indicated.
   c. Style: As indicated.
   d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
   e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
   f. Vent Cylinder, Base Flange, and Rain-Cap **OR** Hood, **as directed** Material: Galvanized steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet, of manufacturer's standard thickness.
   g. Finish:
      1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
      2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
2. Low-Profile, Louvered Penthouse-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
   a. Provide integral frame with base flange, weathertight cap, louver bird screen, and weatherproof sidewall louvers.
   b. Dimensions: As indicated.
   c. Style: As indicated.
   d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
   e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
   f. Integral Frame, Base Flange, Weathertight Cap, and Louver Material: Galvanized steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet, of manufacturer's standard thickness.
   g. Finish:
      1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
      2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
3. Directional Louvered Pedestal-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
   a. Provide integral weathertight base cap, integral outlet duct, weathertight sidewalls, bird screen, and weatherproof sidewall louver.

b. Dimensions: As indicated.
c. Style: As indicated.
d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
f. Weathertight Base Cap, Outlet Duct, Sidewall, and Louver Material: Galvanized steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet, of manufacturer's standard thickness.
g. Finish:
1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.

4. Turbine-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
a. Provide integral weathertight base cap, outlet duct, and rotating louvered turbine.
b. Dimensions: As indicated.
c. Style: As indicated.
d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
f. Weathertight Base Cap, Outlet Duct, and Turbine Material: Galvanized steel **OR** Aluminum, **as directed**, sheet, of manufacturer's standard thickness.
g. Finish:
1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.

H. Roof Supports
1. Pipe Roof Supports: Adjustable height, extruded-aluminum tube, urethane insulation filled, 2 inches (50 mm) in diameter, with aluminum base plates and manufacturer's recommended hardware for mounting to structure **OR** structural roof deck, **as directed**, and extruded-aluminum carrier assemblies, suitable for quantity of pipe runs and sizes, with EPDM end caps. Include manufacturer's standard hardware for mounting to structure or structural roof deck.
a. Pipe Support Height: As indicated.
b. Pipe Roller Assembly: Stainless-steel roller assembly sized for supported pipes with extruded aluminum.
c. Pipe Support Flashing: Insulated **OR** Uninsulated, **as directed**, sleeve flashings with integral base flange, and EPDM grommetted top seal and base seals.
1) Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick **OR** Copper sheet, 16 oz. (0.55 mm) thick, **as directed**.
2. Terrace Lighting Roof Supports: Epoxy-coated hollow structural section steel pipe support, urethane insulation filled, with epoxy-coated steel base plates and manufacturer's recommended hardware for mounting to structure **OR** structural roof deck, **as directed**, 14 inches (356 mm) **OR** 18 inches (457 mm), **as directed**, high, with galvanized threaded cap.
a. Lighting Pole Mounting: Stainless-steel lighting pole adapter **OR** Epoxy-coated steel plate with stainless-steel studs, **as directed**.
b. Pipe Support Flashing: Insulated **OR** Uninsulated, , metal sleeve flashings with integral base flange, and EPDM grommetted top seal and base seals.
1) Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick **OR** Copper sheet, 16 oz. (0.55 mm) thick, **as directed**.
3. Light-Duty Pipe Roof Supports: Extruded-aluminum base assembly and Type 304 stainless-steel roller assembly for pipe sizes indicated, including manufacturer's standard hardware for mounting to structure or structural roof deck.
4. Duct Roof Supports: 2-inch- (50-mm-) diameter, extruded-aluminum, urethane-insulated supports, including manufacturer's standard hardware for mounting to structure or structural roof deck.

I. Roof Walkways

1. Roof Walkway: Multiple C-shaped-channel formed-metal planks, as follows, with upper surface punched in serrated diamond or rectangular shapes to produce raised slip-resistant surface and drainage holes. Provide support framing, brackets, connectors, nosings, and other accessories and components needed for complete installation. Include step units for changes in elevation.
   a. Plank Width: 4-3/4 inches (121 mm) **OR** 7 inches (178 mm) **OR** 9-1/2 inches (241 mm) **OR** 11-3/4 inches (298 mm) **OR** 18-3/4 inches (476 mm) **OR** 24 inches (610 mm) **OR** As indicated, **as directed**.
   b. Walkway Width: As indicated.
   c. Channel Depth: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** As indicated., **as directed**
   d. Metal Material: -0.079-inch- (2.0-mm-) thick, hot-dip galvanized steel sheet **OR** 0.108-inch- (2.8-mm-) thick, hot-dip galvanized steel sheet **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel sheet **OR** 0.080-inch- (2.03-mm-) thick, mill-finished aluminum sheet **OR** 0.100-inch- (2.5-mm-) thick, mill-finished aluminum sheet, **as directed**.
   e. Provide isolation pads attached to supports so supports are completely isolated from roof membrane surface.

J. Preformed Flashings
1. Exhaust Vent Flashings: Double-wall metal flashing sleeve, urethane insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted **OR** perforated, **as directed**, metal collar, and as follows:
   a. Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick, mill finished **OR** Copper sheet, 16 oz. (0.55 mm thick), **as directed**.
   b. Diameter: As indicated.
2. Vent Stack Flashing: Metal flashing sleeve, with integral deck flange, uninsulated, and as follows:
   a. Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick, mill finished **OR** Copper sheet, 16 oz. (0.55 mm thick), **as directed**.
   b. Height: As indicated..
   c. Diameter: As indicated.

1.3 EXECUTION

A. Installation
1. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
2. Install roof accessories to fit substrates and to result in watertight performance.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   a. Coat concealed side of uncoated aluminum **OR** stainless-steel, **as directed**, roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   b. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   c. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
4. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

5. Seal joints with elastomeric **OR** butyl, **as directed**, sealant as required by manufacturer of roof accessories.

END OF SECTION 07 72 23 00

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Task	Specification	Specification Description
07 72 26 00	07 72 23 00	Roof Accessories
07 72 33 00	07 72 23 00	Roof Accessories
07 72 36 00	07 72 23 00	Roof Accessories
07 72 63 00	01 22 16 00	No Specification Required
07 73 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 73 00 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 73 00 00	07 53 16 00	EPDM Membrane Roofing
07 73 00 00	07 05 13 00a	CSPE Membrane Roofing
07 73 00 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 73 00 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 76 16 00	01 22 16 00	No Specification Required

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SECTION 07 81 16 00 - SPRAYED FIRE-RESISTIVE MATERIALS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for sprayed fire-resistive materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
   a. Concealed SFRM.
   b. Exposed SFRM.
   c. Exposed intumescent mastic fire-resistive coatings.

C. Definitions
1. SFRM: Sprayed fire-resistive material.
2. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed, **as directed**.
3. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed, that are accessible through suspended ceilings **OR** that are in elevator shafts and machine rooms **OR** that are in mechanical rooms **OR** that are in air-handling plenums **OR** and that are identified as exposed on Drawings, **as directed**.

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show extent of sprayed fire-resistive material for each construction and fire-resistance rating, applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction, and minimum thicknesses.
3. Product certificates **OR** test reports, **as directed**.
4. Compatibility and adhesion test reports.
5. Research/evaluation reports.
6. Field quality-control test and special inspection, **as directed**, reports.

E. Quality Assurance
1. Installer Qualifications: A qualified installer approved by SFRM manufacturer to install manufacturer's products. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
2. SFRM Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
   a. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   b. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
   c. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

3. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
   a. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   b. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with SFRM.
4. Fire-Test-Response Characteristics: Where indicated, provide products identical to those tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.
   a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
   b. Identify products with appropriate markings of applicable testing and inspecting agency.
5. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
6. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
2. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
3. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

G. Project Conditions
1. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F (4 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
2. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

H. Warranty
1. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Concealed SFRM
1. Material Composition: Manufacturer's standard product, as follows **OR** either of the following, **as directed**:
   a. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
   b. Concealed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.
2. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

a. Dry Density: 15 lb/cu. ft. (240 kg/cu. m) for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
b. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:
   1) Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch (6 mm).
   2) Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of SFRM is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.
   3) No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft. (240 kg/cu. m).
c. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736 based on laboratory testing of 0.75-inch (19-mm) minimum thickness of SFRM.
d. Compressive Strength: 5.21 lbf/sq. in. (35.9 kPa) minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified but not less than 15 lb/cu. ft. (240 kg/cu. m).
e. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
f. Deflection: No cracking, spalling, or delamination per ASTM E 759.
g. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
h. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch (19 mm), maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
i. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1) Flame-Spread Index: 10 or less.
   2) Smoke-Developed Index: 0.
j. Fungal Resistance: No observed growth on specimens per ASTM G 21.

B. Exposed SFRM
1. Material Composition: Manufacturer's standard product, as follows:
   a. Exposed Cementitious SFRM: Factory-mixed, dry, cement aggregate formulation; or chloride-free formulation of gypsum or portland cement binders, additives, and inorganic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
   b. Exposed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.
2. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
   a. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 22 lb/cu. ft. (352 kg/cu. m).
   b. Bond Strength: 434 lbf/sq. ft. (21 kPa) minimum per ASTM E 736.
   c. Compressive Strength: 51 lbf/sq. in. (351 kPa) minimum per ASTM E 761.
   d. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 39 lb/cu. ft. (625 kg/cu. m).
   e. Bond Strength: 1000 lbf/sq. ft. (48 kPa) minimum per ASTM E 736.

f. Compressive Strength: 300 lbf/sq. in. (2067 kPa) minimum per ASTM E 761.
g. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
h. Deflection: No cracking, spalling, or delamination per ASTM E 759.
i. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
j. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) per ASTM E 859.
k. Combustion Characteristics: Passes ASTM E 136.
l. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1) Flame-Spread Index: 10 or less.
   2) Smoke-Developed Index: 0.
m. Fungal Resistance: No observed growth on specimens per ASTM G 21.
n. For exterior applications of SFRM, provide formulation listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction for surfaces exposed to exterior.

C. Exposed Intumescent Mastic Fire-Resistive Coatings
1. Fire-Resistive, Intumescent Mastic Coating: Factory-mixed formulation.
   a. Water-Based Formulation: Approved by manufacturer and authorities having jurisdiction and investigated for Interior General **OR** Conditioned Interior Space, **as directed**, Purpose by UL.
   b. Non-Water-Based Formulation: Approved by manufacturer and UL or another testing and inspecting agency acceptable to authorities having jurisdiction and investigated for Interior General Purpose by UL **OR** investigated for Interior General Purpose and Exterior Use by UL **OR** tested per ASTM E 1529 **OR** tested per UL 1709, **as directed**.
   c. Multicomponent system consisting of intumescent base coat and topcoat.
2. Color and Gloss: As selected from manufacturer's full range.

D. Auxiliary Fire-Resistive Materials
1. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
2. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
   a. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.
   b. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
3. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of SFRM.
4. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.
5. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.
6. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of intumescent mastic coating fire-resistive material. Include pins and attachment.
7. Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.
8. Topcoat: Type recommended in writing by manufacturer of each SFRM for application over concealed **OR** exposed, **as directed**, SFRM.

9. Cement-Based Topcoat: Factory-mixed, cementitious hardcoat formulation recommended in writing by manufacturer of SFRM for trowel or spray application over concealed **OR** exposed, **as directed**, SFRM.
10. Veneer-Plaster Topcoat: Factory-mixed formulation of a latex-modified, portland cement-based veneer plaster recommended in writing by manufacturer of SFRM for trowel or spray application over concealed **OR** exposed, **as directed**, SFRM.
11. Water-Based Permeable Topcoat: Factory-mixed formulation recommended in writing by manufacturer of SFRM for brush, roller, or spray application over concealed **OR** exposed, **as directed**, SFRM. Provide application at a rate of 120 sq. ft./gal. (3 sq. m/L) **OR** 60 sq. ft./gal. (1.5 sq. m/L) **OR** 30 sq. ft./gal. (0.75 sq. m/L), **as directed**.

1.3 EXECUTION

A. Preparation

1. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
2. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
3. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.
4. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

B. Application, General

1. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
2. Apply SFRM that is identical to products tested as specified in Part 1.1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
3. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric, as required, to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by SFRM manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric, as required, to substrate.
4. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by SFRM manufacturer for material and application indicated.
5. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.
6. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.
7. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply SFRM that differs in color from that of encapsulant over which it is applied.
8. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

C. Application, Concealed SFRM

1. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 1.2 "Concealed SFRM" Article.
2. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating and where indicated.
3. Cure concealed SFRM according to product manufacturer's written recommendations.
4. Apply sealer to concealed SFRM where indicated.
5. Apply topcoat to concealed SFRM where indicated.

D. Application, Exposed SFRM
1. Apply exposed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
   a. For steel beams and bracing, provide a thickness of not less than 1 inch (25 mm).
   b. For metal floor or roof decks, provide a thickness of not less than 1/2 inch (13 mm).
2. Provide a uniform finish complying with description indicated for each type of material and matching the Owner's sample or, if none, finish approved for field-erected mockup.
3. Apply exposed cementitious SFRM to produce the following finish:
   a. Spray-textured finish with no further treatment.
   b. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
   c. Skip-troweled finish with leveled surface, smoothed-out texture, and neat edges.
   d. Smooth, troweled finish with surface markings eliminated and edges squared.
4. Apply exposed sprayed-fiber fire-resistive material to produce the following finish:
   a. Spray-textured finish.
   b. Sealer where indicated.
   c. Topcoat where indicated\.
5. Cure exposed SFRM according to product manufacturer's written recommendations.

E. Application, Exposed Intumescent Mastic Fire-Resistive Coatings
1. Apply exposed intumescent mastic fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
2. Apply intumescent mastic fire-resistive coating as follows:
   a. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
   b. Finish: Spray-textured finish with no further treatment.
   c. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

F. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
   a. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
2. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
   a. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93-sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.093-sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.

b. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.

c. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

d. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.

1) Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.

2) If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.

e. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

3. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

4. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

G. Cleaning, Protecting, And Repair

1. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

2. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Final Completion.

3. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.

4. Repair or replace work that has not successfully protected steel.

END OF SECTION 07 81 16 00

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Task	Specification	Specification Description
07 81 23 00	07 81 16 00	Sprayed Fire-Resistive Materials
07 81 33 00	07 81 16 00	Sprayed Fire-Resistive Materials

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SECTION 07 84 13 16 - THROUGH-PENETRATION FIRESTOP SYSTEMS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for through-penetration firestop systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

C. Performance Requirements
1. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
2. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
   a. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
   b. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
      1) Penetrations located outside wall cavities.
      2) Penetrations located outside fire-resistance-rated shaft enclosures.
   c. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide **OR** Provide, **as directed**, through-penetration firestop systems with L-ratings indicated **OR** of not more than, **as directed**, 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).
3. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   b. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
   c. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
4. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

a. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

E. Quality Assurance
1. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
2. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1.1 "Performance Requirements" Article:
a. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL **OR** OPL **OR** ITS, **as directed**, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
b. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1.1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
3. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
4. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by the Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

F. Delivery, Storage, And Handling
1. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
2. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.2 PRODUCTS

A. Firestopping
1. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
2. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1.1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
a. Permanent forming/damming/backing materials, including the following:
1) Slag-/rock-wool-fiber insulation.
2) Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
3) Fire-rated form board.
4) Fillers for sealants.
b. Temporary forming materials.
c. Substrate primers.

d. Collars.
e. Steel sleeves.

B. Fill Materials
1. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 1.3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
2. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
3. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
4. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
5. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
6. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
7. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
8. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
9. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
10. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
11. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
    a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
    b. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
    c. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

C. Mixing: For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

1.3 EXECUTION

A. Through-Penetration Firestop System Installation
1. General: Install through-penetration firestop systems to comply with Part 1.1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

2. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
3. Install fill materials for firestop systems by proven techniques to produce the following results:
   a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   c. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
4. Identification: Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. Include the following information on labels:
   a. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
   b. Contractor's name, address, and phone number.
   c. Through-penetration firestop system designation of applicable testing and inspecting agency.
   d. Date of installation.
   e. Through-penetration firestop system manufacturer's name.
   f. Installer's name.

B. Field Quality Control
1. Inspecting Agency: Engage an independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
2. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
3. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

C. Cleaning And Protecting
1. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
2. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

D. Through-Penetration Firestop System Schedule
1. Choices in the following paragraphs which are contained within brackets shall be as required to satisfy building and local code requirements.
2. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
3. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."
4. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.

5. Firestop Systems with No Penetrating Items:
   a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [0001-0999].
   b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type G.
   c. ITS-Listed Systems: <Insert ITS design number(s).>
   d. Type of Fill Materials: One or more of the following:
      1) Latex sealant.
      2) Silicone sealant.
      3) Intumescent putty.
      4) Mortar.
6. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
   a. UL-Classified Systems: [C-AJ-] [C-BJ-] [C-BK-] [F-A-] [F-B-] [F-C-] [W-J-] [W-K-] [W-L-] <Insert one or more four-digit numbers> [1001-1999].
   b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type A.
   c. ITS-Listed Systems: <Insert ITS design number(s).>
   d. Type of Fill Materials: One or more of the following:
      1) Latex sealant.
      2) Silicone sealant.
      3) Intumescent putty.
      4) Mortar.
7. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:
   a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [2001-2999].
   b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type B.
   c. ITS-Listed Systems: <Insert ITS design number(s).>
   d. Type of Fill Materials: One or more of the following:
      1) Latex sealant.
      2) Silicone sealant.
      3) Intumescent putty.
      4) Intumescent wrap strips.
      5) Firestop device.
8. Firestop Systems for Electrical Cables:
   a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [3001-3999].
   b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type D.
   c. ITS-Listed Systems: <Insert ITS design number(s).>
   d. Type of Fill Materials: One or more of the following:
      1) Latex sealant.
      2) Silicone sealant.
      3) Intumescent putty.
      4) Silicone foam.
      5) Pillows/bags.
9. Firestop Systems for Cable Trays:
   a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [W-J-] [W-K-] [W-L-] <Insert one or more four-digit numbers> [4001-4999].
   b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type D.
   c. ITS-Listed Systems: <Insert ITS design number(s).>
   d. Type of Fill Materials: One or more of the following:
      1) Latex sealant.
      2) Intumescent putty.
      3) Silicone foam.

4) Pillows/bags.
5) Mortar.

10. Firestop Systems for Insulated Pipes:
    a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [5001-5999].
    b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type C.
    c. ITS-Listed Systems: <Insert ITS design number(s).>
    d. Type of Fill Materials: One or more of the following:
        1) Latex sealant.
        2) Intumescent putty.
        3) Silicone foam.
        4) Intumescent wrap strips.
11. Firestop Systems for Miscellaneous Electrical Penetrants:
    a. UL-Classified Systems: [C-AJ-] [F-A-] [W-L-] <Insert one or more four-digit numbers> [6001-6999].
    b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type E.
    c. ITS-Listed Systems: <Insert ITS design number(s).>
    d. Type of Fill Materials: One or more of the following:
        1) Latex sealant.
        2) Intumescent putty.
        3) Mortar.
12. Firestop Systems for Miscellaneous Mechanical Penetrants:
    a. UL-Classified Systems: [C-AJ-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [7001-7999].
    b. ITS-Listed Systems: <Insert ITS design number(s).>
    c. Type of Fill Materials: One or both of the following:
        1) Latex sealant.
        2) Mortar.
13. Firestop Systems for Groupings of Penetrants:
    a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [8001-8999].
    b. ITS-Listed Systems: <Insert ITS design number(s).>
    c. Type of Fill Materials: One or more of the following:
        1) Latex sealant.
        2) Mortar.
        3) Intumescent wrap strips.
        4) Firestop device.
        5) Intumescent composite sheet.

END OF SECTION 07 84 13 16

SECTION 07 84 13 16a - FIRE-RESISTIVE JOINT SYSTEMS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for fire-resistive joint systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes fire-resistive joint systems for the following:
   a. Floor-to-floor joints.
   b. Floor-to-wall joints.
   c. Head-of-wall joints.
   d. Wall-to-wall joints.
   e. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.

C. Performance Requirements
1. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
2. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
   a. Load-bearing capabilities as determined by evaluation during the time of test.
3. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated below and those indicated in the Fire-Resistive Joint System Schedule at the end of Part 1.3, as determined by IBC Standard **OR** NFPA 285, **as directed,** and UL 2079.
   a. UL-Listed, Perimeter Fire-Containment Systems: Integrity ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
   b. OPL-Listed, Perimeter Fire-Barrier Systems: F-ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
4. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Submittals
1. Product Data: For each product indicated.
2. Shop Drawings: For each fire-resistive joint system.
3. Qualification Data: For Installer.
4. Field quality-control test reports.
5. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
6. Research/Evaluation Reports: For each type of fire-resistive joint system.

E. Quality Assurance
1. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
2. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
3. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

a. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL **OR** OPL, **as directed**, or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
b. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
1) Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
2) Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

4. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
5. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

F. Delivery, Storage, And Handling
1. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
2. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.2 PRODUCTS

A. Fire-Resistive Joint Systems
1. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
2. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

1.3 EXECUTION

A. Installation
1. Install fire-resistive joint systems to comply with Part 1.1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
2. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

B. Field Quality Control
1. Inspecting Agency: Engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.
2. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.

a. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

3. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
4. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

C. Fire-Resistive Joint System Schedule
1. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.
2. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly and an Exterior Curtain-Wall Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG **OR** OPL's "Directory of Listed Building Products, Materials, & Assemblies" as perimeter fire-barrier systems, **as directed**.

END OF SECTION 07 84 13 16a

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SECTION 07 84 13 16b - FIRESTOPPING

1.1 DESCRIPTION OF WORK

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

1.2 GENERAL

A. System Description
   1. Performance Requirements: Comply with following:
      a. Firestopping: Consist of material or combination of materials to form effective barrier against spread of flame, smoke, and gases, and maintain integrity of fire-resistance rated walls, partitions, floors, and ceiling-floor assemblies at penetrations.
         1) Penetrations: Include annular space around pipes, ducts, chimneys, tubes, conduit, wires, cables, and vents.

B. Submittals
   1. Product Data:
      a. Composition and performance characteristics.
      b. List of FM, UL, or WH classification number of systems installed.
   2. Quality Assurance/Control Submittals:
      a. Test Reports: If not FM, UL, or WH listed, submit certified test results for ASTM E 814 tests by UL, FM, WH, or other accredited independent laboratory demonstrating compliance of firestopping with specified requirements.
      b. Manufacturers installation instructions.

C. Quality Assurance
   1. Regulatory Requirements: Comply with applicable building-code requirements for firestopping.

D. Delivery, Storage, And Handling
   1. Packing, Shipping, Handling, and Unloading: Deliver in original, unopened containers with manufacturer's labels.
      a. Products: FM, UL, or WH labeled and FM, UL, or WHI listed.
   2. Storage and Protection: Store firestopping materials in accordance with manufacturer's recommendations.

1.3 PRODUCTS

A. Fire-Rated Penetration Sealant Systems
   1. Firestopping Materials: Commercially manufactured asbestos-free products complying with following minimum requirements:
      a. Material:
         1) Flame Spread: ASTM E 84 or UL 723, 25 or less.
         2) Smoke Developed Rating: ASTM E 84 or UL 723, 50 or less.
         3) Material: Approved firestopping material as listed in UL 05, FM P7825, or WH Certified Listing.
      b. Material Properties:

1) Contain no flammable or toxic solvents and have no dangerous or flammable outgassing during the drying or curing of products.
2) Non-toxic to human beings at all stages of application and during fire conditions.
3) Water-resistant after drying or curing and unaffected by high humidity, condensation, or transient water exposure.

c. Devices and systems requiring heat activation to seal opening created by burning or melting of penetrant shall exhibit demonstrated ability to function as required for floors and walls of construction and thickness similar to those to be firestopped.

2. Firestopping System Requirements: Materials from single manufacturer capable of maintaining effective barrier against flame, smoke, and gases in accordance with ASTM E 814 and UL 1479.
   a. Fire-Resistance Rating: Equal or greater than fire-resistance rating of assembly in which it is being placed.
   b. F Ratings: Equal to or greater than fire-resistance rating of assembly penetrated.
   c. T Ratings: Equal to or greater than fire-resistance rating of assembly penetrated at following locations:
      1) Penetrations located outside of wall cavities.
      2) Penetrations located outside of fire-resistive shaft enclosures.
      3) Penetrations located in enclosures with doors required to have temperature-rise rating.
      4) Penetrations with penetrating hems larger than 100 mm (4 inch) diameter nominal pipe or 10 320 sq. mm (16 square inches) in cross-sectional area.
   d. System: Listed in UL 05, FM 7825, or WH Certified Listing, or tested by approved laboratory in accordance with ASTM E 814.
   e. System: Suitable for firestopping of penetrations made by steel, glass, plastic. and insulated pipe.
   f. Penetration by Insulated Pipe: Does not require removal of insulation.

1.4 EXECUTION

A. Examination
   1. Verification of Conditions:
      a. Existing Conditions: Examine penetrations before beginning installation.
      b. Do not proceed with installation until conditions are satisfactory.

B. Installation
   1. Fire-Rated Penetration Sealant Systems: Install in accordance with UL 05, FM P7825, or WH systems and manufacturers recommendations to maintain required fire-separation rating.
      a. Preparation: Clean surfaces in contact with firestopping materials that may affect proper fitting or required fire rating. Prime if required. Dam void if required.
      b. Penetrations: Completely fill void with sealant materials to smooth surface, flush with adjacent surfaces and in contact with surfaces formed by openings and penetrating items ensuring adhesion. Provide sealant in thickness to achieve required fire rating and smoke barrier.
      c. Firestopping at Voids 100 mm (4 inches) or More in Any Direction: Capable of supporting same load as floor is designed to support or protected by permanent barrier.
      d. Remove any excess sealant from adjacent surfaces.
   2. Firestopping: Provide at following locations:
      a. Penetrations of duct, chimney, conduit, tubing, cable, and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
      b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
      c. Gaps at intersection of fire-rated floor stabs and walls.
      d. Gaps at perimeter of fire-rated walls and partitions, such as between top of walls and bottom of floor or roof decks.
      e. Construction joints in fire-rated floors, walls, and partitions.

f. Other locations where required to maintain fire-resistance rating of the construction.
g. Other locations as indicated on Drawings (if any).

C. Field Quality Control
1. Inspection: Examine areas to be firestopped prior to concealing or enclosing to ensure proper installation.
a. Keep areas of firestopping work accessible until inspection by authorities having jurisdiction over work.

END OF SECTION 07 84 13 16b

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Task	Specification	Specification Description
07 84 13 19	07 84 13 16	Through-Penetration Firestop Systems
07 84 13 19	07 84 13 16a	Fire-Resistive Joint Systems
07 84 13 19	07 84 13 16b	Firestopping
07 84 16 00	03 05 13 00	Cast-In-Place Concrete
07 84 43 00	07 84 13 16	Through-Penetration Firestop Systems
07 84 43 00	07 84 13 16a	Fire-Resistive Joint Systems
07 84 43 00	07 84 13 16b	Firestopping

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SECTION 07 84 56 13 - BOARD FIRE PROTECTION

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for board fire protection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Calcium silicate board fire protection.
b. Mineral-fiber board fire protection.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Structural framing plans indicating the following:
a. Locations and types of surface preparations required before applying board fire protection.
b. Extent of board fire protection for each construction and fire-resistance rating, including the following:
1) Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
a) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with same maximum tensile stress as each steel joist indicated on Drawings **OR** in a schedule, **as directed**. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.
2) Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
3) Treatment of sprayed fire-resistive material after application.
3. Product Certificates: For each type of board fire protection, from manufacturer.
4. Research/Evaluation Reports: For board fire protection.

D. Quality Assurance
1. Source Limitations: Obtain board fire-protection materials from single source from single manufacturer.
2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" **OR** UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency, **as directed**, acceptable to authorities having jurisdiction, for board fireproofing serving as direct-applied protection tested per ASTM E 119.

E. Coordination
1. Coordinate installation of board fire protection with other construction specified in other Sections.
a. Do not install board fire protection on structural members until piping and other construction behind fire-resistive materials have been completed, uninterrupted coverage of fire-resistive materials can be provided, and the need for subsequent cutting and patching of fire-resistive materials has been eliminated.
b. Do not install enclosing or concealing construction until after board fire protection has been applied and inspected by authorities having jurisdiction.

1.2 PRODUCTS

A. Board Fire Protection
1. Calcium Silicate Board: Rigid board containing no asbestos and consisting primarily of lime, silica, inert fillers, and cellulosic reinforcing fibers; of thickness required to produce fire-resistance rating indicated; with flame-spread and smoke-developed indexes of zero per ASTM E 84; passing ASTM E 136 for combustion characteristics.
a. Finish: Sanded finish on both sides **OR** one side, **as directed**.
2. Mineral-Fiber Board: Unfaced **OR** Foil-faced **OR** Fiberglass mat-faced, **as directed**, rigid board produced by combining slag-wool-/rock-wool fibers with thermosetting resin binders passing ASTM E 136 for combustion characteristics; of thickness required to produce fire-resistance rating indicated.
a. Maximum Density: 8 lb/cu. ft. (128 kg/cu. m) **OR** 10 lb/cu. ft. (160 kg/cu. m) **OR** 12 lb/cu. ft. (192 kg/cu. m), **as directed**, per ASTM C 612.
b. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 15 **OR** zero, **as directed**, and 5 **OR** zero, **as directed**, respectively, per ASTM E 84.

B. Accessories
1. Anchorage Accessories: Provide manufacturer's standard board-anchorage components complying with related design of UL or of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Joint Treatment and Finishing Materials: For exposed calcium silicate board applications, provide joint treatment tape and joint compounds recommended in writing by board manufacturer for finishing surfaces.

1.3 EXECUTION

A. Preparation
1. Remove rust and scale from steel substrates at welded steel stud anchorage locations.

B. Installation
1. Install board fire protection according to manufacturer's written instructions.
2. Install board fire protection to comply with requirements for layer thicknesses and number, construction of joints and corners, and anchorage methods applicable to fire-resistance-rated assemblies indicated.
3. Finish exposed calcium silicate board to comply with board manufacturer's written instructions and as follows:
a. At joints in calcium silicate board, embed tape in joint compound and apply first, fill, and finish coats of joint compounds over tape, fastener heads, and accessories.
b. Apply a thin, uniform skim coat of joint compound over entire surface.
c. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges.

C. Protection
1. Replace or repair board fire protection that has been cut away to facilitate other construction. Maintain complete coverage of full thickness on members and substrates protected by board fire protection.
a. Provide final protection and maintain conditions in a manner acceptable to Installer, manufacturer, and authorities having jurisdiction to ensure that board fire protection is without damage or deterioration at time of Final Completion.

END OF SECTION 07 84 56 13

Task	Specification	Specification Description
07 84 56 13	07 81 16 00	Sprayed Fire-Resistive Materials

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SECTION 07 91 23 00 - JOINT SEALANTS

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Silicone joint sealants.
b. Urethane joint sealants.
c. Polysulfide joint sealants.
d. Latex joint sealants.
e. Solvent-release-curing joint sealants.
f. Preformed joint sealants.
g. Acoustical joint sealants.

C. Preconstruction Testing
1. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
a. Use ASTM C 1087 **OR** manufacturer's standard test method, **as directed**, to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
b. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
c. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
d. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
e. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
2. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
a. Locate test joints where indicated on Project or, if not indicated, as directed by the Owner.
b. Conduct field tests for each application indicated below:
1) Each kind of sealant and joint substrate indicated.
c. Notify the Owner seven days in advance of dates and times when test joints will be erected.
d. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
1) Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
a) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
e. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
f. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with

requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

D. Submittals
1. Product Data: For each joint-sealant product indicated.
2. LEED Submittal:
   a. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.
3. Samples: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
4. Joint-Sealant Schedule: Include the following information:
   a. Joint-sealant application, joint location, and designation.
   b. Joint-sealant manufacturer and product name.
   c. Joint-sealant formulation.
   d. Joint-sealant color.
5. Qualification Data: For qualified Installer and testing agency.
6. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
7. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
9. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
10. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
11. Field-Adhesion Test Reports: For each sealant application tested.
12. Warranties: Sample of special warranties.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
3. Product Testing: Test joint sealants using a qualified testing agency.
   a. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
   b. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions
1. Do not proceed with installation of joint sealants under the following conditions:
   a. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C, **as directed**.
   b. When joint substrates are wet.
   c. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

d. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

G. Warranty
1. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
a. Warranty Period: Two years from date of Final Completion.
2. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
a. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
b. Disintegration of joint substrates from natural causes exceeding design specifications.
c. Mechanical damage caused by individuals, tools, or other outside agents.
d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.2 PRODUCTS

A. Materials, General
1. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
2. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
a. Architectural Sealants: 250 g/L.
b. Sealant Primers for Nonporous Substrates: 250 g/L.
c. Sealant Primers for Porous Substrates: 775 g/L.
3. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
a. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
4. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
5. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
6. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

B. Silicone Joint Sealants
1. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
2. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
3. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
4. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

5. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
6. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.
7. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
8. Multicomponent, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade P, Class 100/50, for Use T.
9. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
10. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

C. Urethane Joint Sealants
1. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
2. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
3. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
4. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.
5. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
6. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
7. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
8. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
9. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
10. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
11. Immersible, Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.
12. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.
13. Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type M, Grade P, Class 25, for Use T and I.

D. Polysulfide Joint Sealants
1. Single-Component, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
2. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
3. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
4. Multicomponent, Pourable, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
5. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.

E. Latex Joint Sealants
1. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

F. Solvent-Release-Curing Joint Sealants
1. Acrylic-Based Joint Sealant: ASTM C 1311.
2. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.

G. Preformed Joint Sealants
1. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
2. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

H. Acoustical Joint Sealants
1. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

I. Joint Sealant Backing
1. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
2. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) **OR** Type O (open-cell material) **OR** Type B (bicellular material with a surface skin) **OR** or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, **as directed**, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

J. Miscellaneous Materials
1. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

1.3 EXECUTION

A. Examination
1. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   1) Concrete.
   2) Masonry.
   3) Unglazed surfaces of ceramic tile.
   4) Exterior insulation and finish systems.
c. Remove laitance and form-release agents from concrete.
d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   1) Metal.
   2) Glass.
   3) Porcelain enamel.
   4) Glazed surfaces of ceramic tile.

2. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Installation Of Joint Sealants
1. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
3. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   a. Do not leave gaps between ends of sealant backings.
   b. Do not stretch, twist, puncture, or tear sealant backings.
   c. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
4. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
5. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   a. Place sealants so they directly contact and fully wet joint substrates.
   b. Completely fill recesses in each joint configuration.
   c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
6. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   a. Remove excess sealant from surfaces adjacent to joints.

b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
c. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
d. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
e. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
1) Use masking tape to protect surfaces adjacent to recessed tooled joints.

7. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
a. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
b. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
c. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
d. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

8. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

9. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

D. Field Quality Control
1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
a. Extent of Testing: Test completed and cured sealant joints as follows:
1) Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
2) Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
b. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
c. Inspect tested joints and report on the following:
1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

E. Cleaning
1. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

F. Protection
1. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

G. Joint-Sealant Schedule
1. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   a. Joint Locations:
      1) Control and expansion joints in brick pavers.
      2) Isolation and contraction joints in cast-in-place concrete slabs.
      3) Joints between plant-precast architectural concrete paving units.
      4) Joints in stone paving units, including steps.
      5) Tile control and expansion joints.
      6) Joints between different materials listed above.
      7) Other joints as indicated.
   b. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing **OR** Single component, pourable, traffic grade, neutral curing **OR** Multicomponent, pourable, traffic grade, neutral curing, **as directed**.
   c. Urethane Joint Sealant: Single component, nonsag, traffic grade **OR** Single component, pourable, traffic grade **OR** Multicomponent, nonsag, traffic grade, Class 50 **OR** Multicomponent, nonsag, traffic grade, Class 25, **as directed**.
   d. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade **OR** Multicomponent, pourable, traffic grade, **as directed**.
   e. Preformed Joint Sealant: Preformed foam sealant.
   f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
2. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
   a. Joint Locations:
      1) Joints in pedestrian plazas.
      2) Joints in swimming pool decks.
      3) Other joints as indicated.
   b. Urethane Joint Sealant: Immersible, single component, nonsag, traffic grade **OR** Immersible, single component, pourable, traffic grade **OR** Immersible, multicomponent, nonsag, traffic grade **OR** Immersible, multicomponent, pourable, traffic grade, **as directed**.
   c. Polysulfide Joint Sealant: Immersible, multicomponent, nonsag, traffic grade.
   d. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
3. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   a. Joint Locations:
      1) Construction joints in cast-in-place concrete.
      2) Joints between plant-precast architectural concrete units.
      3) Control and expansion joints in unit masonry.
      4) Joints in dimension stone cladding.

5) Joints in glass unit masonry assemblies.
6) Joints in exterior insulation and finish systems.
7) Joints between metal panels.
8) Joints between different materials listed above.
9) Perimeter joints between materials listed above and frames of doors, windows and louvers.
10) Control and expansion joints in ceilings and other overhead surfaces.
11) Other joints as indicated.

b. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50 **OR** Single component, nonsag, neutral curing, Class 50 **OR** Single component, nonsag, neutral curing, Class 25 **OR** Single component, nonsag, acid curing **OR** Multicomponent, nonsag, neutral curing, **as directed**.
c. Urethane Joint Sealant: Single component, nonsag, Class 100/50 **OR** Single component, nonsag, Class 50 **OR** Single component, nonsag, Class 25 **OR** Multicomponent, nonsag,, Class 50 **OR** Multicomponent, nonsag,, Class 25, **as directed**.
d. Polysulfide Joint Sealant: Single component, nonsag **OR** Multicomponent, nonsag, **as directed**.
e. Preformed Joint Sealant: Preformed silicone **OR** Preformed foam, **as directed**.
f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.

4. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
   a. Joint Locations:
      1) Isolation joints in cast-in-place concrete slabs.
      2) Control and expansion joints in stone flooring.
      3) Control and expansion joints in brick flooring.
      4) Control and expansion joints in tile flooring.
      5) Other joints as indicated.
   b. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing **OR** Single component, pourable, traffic grade, neutral curing **OR** Multicomponent, pourable, traffic grade, neutral curing, **as directed**.
   c. Urethane Joint Sealant: Single component, nonsag, traffic grade **OR** Single component, pourable, traffic grade **OR** Multicomponent, nonsag, traffic grade, Class 50 **OR** Multicomponent, nonsag, traffic grade, Class 25, **as directed**.
   d. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade **OR** Multicomponent, pourable, traffic grade, **as directed**.
   e. Preformed Joint Sealant: Preformed foam.
   f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
5. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   a. Joint Locations:
      1) Control and expansion joints on exposed interior surfaces of exterior walls.
      2) Perimeter joints of exterior openings where indicated.
      3) Tile control and expansion joints.
      4) Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
      5) Joints on underside of plant-precast structural concrete beams and planks.
      6) Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      7) Other joints as indicated.
   b. Joint Sealant: Latex **OR** Acrylic based **OR** Butyl rubber based, **as directed**.
   c. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
6. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   a. Joint Sealant Location:
      1) Joints between plumbing fixtures and adjoining walls, floors, and counters.

2) Tile control and expansion joints where indicated.
3) Other joints as indicated.

b. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone **OR** Single component, nonsag, mildew resistant, acid curing, **as directed**.

c. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.

7. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
   a. Joint Location:
      1) Acoustical joints where indicated.
      2) Other joints as indicated.
   b. Joint Sealant: Acoustical.
   c. Joint-Sealant Color: As selected from manufacturer's full range.

END OF SECTION 07 91 23 00

Task	Specification	Specification Description
07 91 26 00	07 91 23 00	Joint Sealants
07 92 13 00	07 91 23 00	Joint Sealants
07 92 19 00	07 91 23 00	Joint Sealants

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SECTION 07 95 13 13 - ARCHITECTURAL JOINT SYSTEMS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for architectural joint systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
2. See Division 03 Section "Cast-in-place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.

B. Definitions
1. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
2. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
3. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.
4. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

C. Submittals
1. Shop Drawings: Provide placement drawings, including line diagrams and details, and a tabular schedule of architectural joint systems.

D. Quality Assurance
1. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)" and ICC A117.1.
2. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
a. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

1.2 PRODUCTS

A. Materials
1. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
b. Mill Finish.
c. Clear Anodic Finish: Class II, clear anodic coating **OR** Class I, clear anodic coating, **as directed**, complying with AAMA 611.
d. Color Anodic Finish: Class II, color anodic coating **OR** Class I, color anodic coating, **as directed**, complying with AAMA 611.
e. High-Performance Organic Finish (Two-Coat Fluoropolymer): Comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
2. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.
3. Brass: ASTM B 36/B 36M, UNS Alloy C26000 for half hard sheet and coil.

4. Bronze: ASTM B 455, Alloy C38500 for extrusions; Alloy C23000 red brass for plates.
5. Moisture Barrier: PVC , minimum 30 mils thick **OR** EPDM, minimum 45 mils thick **OR** Santoprene, **as directed**.
6. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
7. Compression Seals: ASTM E 1612; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
8. Strip Seals: ASTM E 1783; preformed elastomeric membrane or tubular extrusions having an internal baffle system and secured in or over a joint by a metal locking rail.
9. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
10. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
11. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
12. Accessories: Manufacturer's standard anchors, fasteners, and other accessories as required for complete installations.

B. Architectural Joint Systems, General
   1. General: Provide joint systems of design indicated.
      a. Furnish in longest practicable lengths to minimize splicing. Install with hairline mitered corners where joint changes direction.
      b. Include factory-fabricated closure materials and transition pieces to provide continuous joint systems.
   2. Design architectural joint systems for the following size and movement characteristics:
      a. Nominal Joint Width: As indicated on Drawings **OR** As scheduled, **as directed**.
      b. Movement Capability: Plus or minus 25 percent **OR** Plus or minus 50 percent **OR** Plus or minus 100 percent **OR** As indicated on Drawings **OR** As scheduled, **as directed**.
      c. Type of Movement: As indicated on Drawings **OR** As scheduled **OR** Thermal **OR** Seismic **OR** Wind sway, **as directed**.

C. Architectural Joint Systems For Building Interiors
   1. Floor-to-Floor and Floor-to-Wall Joint Systems:
      a. Type: Cover plate **OR** Center plate **OR** Glide plate **OR** Hidden sightline **OR** Pan **OR** Surface mounted, **as directed**.
         1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
            a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No, 4, **as directed**.
            b) Color: As selected from manufacturer's full range.
      b. Type: Elastomeric **OR** Dual elastomeric, **as directed**, seal.
         1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
            a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No, 4, **as directed**.
            b) Color: As selected from manufacturer's full range.
         2) Seal Material: Santoprene.
            a) Color: As selected from manufacturer's full range.
      c. Cover-Plate Design:
         1) Plain **OR** Serrated **OR** Abrasive filled, **as directed**.
         2) Recessed to accept field-applied finish materials.
            a) Recess Depth: To accommodate adjacent flooring.
      d. Attachment Method: Mechanical anchors **OR** Cast in, **as directed**.
      e. Load Capacity: Standard **OR** Heavy **OR** Extra heavy, **as directed**, duty.
      f. Fire-Resistance Rating: Match adjacent construction.
      g. Moisture Barrier: Manufacturer's standard.
   2. Wall-to-Wall and Wall Corner Joint Systems:

a. Type: Vertical cover plate **OR** Glide plate **OR** Hidden sightline **OR** Snap-on cover **OR** Clip-in cover, **as directed**.
   1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
      a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No, 4, **as directed**.
      b) Color: As selected from manufacturer's full range.

b. Type: Elastomeric seal **OR** Dual elastomeric seal **OR** Accordion, **as directed**.
   1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
      a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No, 4, **as directed**.
      b) Color: As selected from manufacturer's full range.
   2) Seal Material: Santoprene **OR** PVC, **as directed**.
      a) Color: As selected from manufacturer's full range.

c. Type: Flat seal.
   1) Seal Material: Santoprene.
      a) Color: As selected from manufacturer's full range.

d. Fire-Resistance Rating: Match adjacent construction.

e. Moisture Barrier: Manufacturer's standard.

3. Wall-to-Ceiling and Ceiling-to-Ceiling Joint Systems:

a. Type: Cover plate **OR** Glide plate **OR** Snap-on cover **OR** Clip-in cover, **as directed**.
   1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
      a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No, 4, **as directed**.
      b) Color: As selected from manufacturer's full range.

b. Type: Elastomeric seal **OR** Dual elastomeric seal **OR** Accordion, **as directed**.
   1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
      a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear Color: As selected from manufacturer's full range.
      b) Seal Material: Santoprene **OR** PVC, **as directed**.
      c) Color: As selected from manufacturer's full range.

c. Type: Flat seal.
   1) Seal Material: Santoprene.
      a) Color: As selected from manufacturer's full range.

d. Fire-Resistance Rating: Match adjacent construction.

e. Moisture Barrier: Manufacturer's standard.

D. Architectural Joint Systems For Building Exteriors

1. Architectural Joint Systems for Exterior Walls and Soffits:

a. Type: Vertical cover-plate.
   1) Exposed Metal: Aluminum **OR** Stainless steel, **as directed**.
      a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** Class I, color anodic **OR** Class II, color anodic **OR** High-performance organic **OR** No. 2B **OR** No. 4, **as directed**.
      b) Color: As selected from full range of industry colors and color densities.
   2) Secondary Seal: Manufacturer's standard extruded-elastomeric seal designed to prevent water and moisture infiltration.

b. Type: Flat seal.
   1) Seal Material: Santoprene.
      a) Color: As selected from manufacturer's full range.
   2) Secondary Seal: Manufacturer's standard extruded-elastomeric seal designed to prevent water and moisture infiltration.
   3) Pantograph Mechanism: Manufacturer's standard nylon pantographic wind-load support mechanism with stainless-steel fasteners.

c. Type: Preformed cellular foam.

1) Foam Material: Manufacturer's standard **OR** Non-extruded, low-density, crosslinked, nitrogen-blown, ethylene-vinyl-acetate copolymer **OR** Polyurethane, **as directed**.
a) Color: As selected from manufacturer's full range.

d. Fire-Resistance Rating: Match adjacent construction.

E. Architectural Joint Systems For Open-Air Structures

1. Slab-to-Slab Joint Systems for Parking Structures **OR** Plaza Decks **OR** Stadiums, **as directed**:
a. Type: Metal plate.
1) Exposed Metal: Aluminum **OR** Stainless steel, **as directed**.
a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** Class I, color anodic **OR** Class II, color anodic **OR** High-performance organic **OR** No. 2B **OR** No. 4, **as directed**.
b) Color: As selected from full range of industry colors and color densities.
b. Type: Sealant T-joint **OR** Rubber pad **OR** Compression seal **OR** Strip seal **OR** Winged seal **OR** Epoxy-bonded seal **OR** Split-slab membrane, **as directed**.
1) Seal Material: Santoprene **OR** Neoprene **OR** Silicone **OR** EPDM **OR** PVC **OR** Manufacturer's standard, **as directed**.
a) Color: As selected from manufacturer's full range.
c. Attachment Method: Mechanical anchors **OR** Cast in **OR** Elastomeric concrete header **OR** Compressed, epoxy adhered **OR** Compressed, lubricant adhesive adhered, **as directed**.
d. Load Capacity: Heavy **OR** Extra heavy, **as directed**, duty.
e. Fire-Resistance Rating: Match adjacent construction.
f. Gutter: Flexible, fabric-reinforced neoprene gutter system with drain tubes.

2. Slab-to-Wall Joint Systems for Parking Structures **OR** Plaza Decks **OR** Stadiums, **as directed**:
a. Type: Metal plate.
1) Exposed Metal: Aluminum **OR** Stainless steel, **as directed**.
a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** Class I, color anodic **OR** Class II, color anodic **OR** High-performance organic **OR** No. 2B **OR** No. 4, **as directed**.
b) Color: As selected from full range of industry colors and color densities.
b. Type: Sealant T-joint **OR** Rubber pad **OR** Compression seal **OR** Strip seal **OR** Winged seal **OR** Epoxy-bonded seal **OR** Split-slab membrane, **as directed**.
1) Seal Material: Santoprene **OR** Neoprene **OR** Silicone **OR** EPDM **OR** PVC **OR** Manufacturer's standard, **as directed**.
a) Color: As selected from manufacturer's full range.
c. Attachment Method: Mechanical anchors **OR** Cast in **OR** Elastomeric concrete header **OR** Compressed, epoxy adhered **OR** Compressed, lubricant adhesive adhered, **as directed**.
d. Fire-Resistance Rating: Match adjacent construction.
e. Gutter: Flexible, fabric reinforced neoprene gutter system with drain tubes.

3. Wall-to-Wall Joint Systems for Parking Structures **OR** Plaza Decks **OR** Stadiums, **as directed**:
a. Type: Compression seal.
1) Seal Material: Santoprene **OR** Neoprene **OR** Silicone **OR** EPDM **OR** PVC **OR** Manufacturer's standard, **as directed**.
a) Color: As selected from manufacturer's full range.
b. Type: Preformed cellular foam.
1) Foam Material: Manufacturer's standard **OR** Non-extruded, low-density, crosslinked, nitrogen-blown, ethylene-vinyl-acetate copolymer **OR** Polyurethane, **as directed**.
a) Color: As selected from manufacturer's full range.
c. Attachment Method: Mechanical anchors **OR** Cast in **OR** Compressed, epoxy adhered **OR** Compressed, lubricant adhesive adhered, **as directed**.
d. Fire-Resistance Rating: Match adjacent construction.

F. Finishes

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

1.3 EXECUTION

A. Installation
1. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.
2. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
   a. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   b. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   c. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   d. Locate in continuous contact with adjacent surfaces.
   e. Support underside of frames continuously to prevent vertical deflection when in service.
   f. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
3. Seals in Metal Frames: Install elastomeric seals in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   a. Provide in continuous lengths for straight sections.
   b. Seal transitions according to manufacturer's written instructions.
4. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces **OR** sides of slabs, **as directed**, before installing compression seals.
5. Foam Seals: Install with adhesive recommended by manufacturer.
6. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.
7. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.
8. Fire-Resistance-Rated Assemblies: Coordinate so complete assemblies comply with assembly performance requirements.
   a. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
9. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings.

B. Protection
1. Do not remove protective covering until finish work in adjacent areas is complete.
2. Protect the installation from damage by work of other Sections.

END OF SECTION 07 95 13 13

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SECTION 07 95 13 16 - ROOF EXPANSION ASSEMBLIES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for roof expansion assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Metal-flanged, bellows-type roof expansion assemblies.
b. Aluminum roof expansion assemblies.
c. Seismic roof expansion assemblies.

C. Performance Requirements
1. General: Provide roof expansion assemblies that, when installed, remain watertight within movement limitations specified by manufacturer.

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, joints, splices, locations of joints and splices, intersections, transitions, fittings, and attachments to other work. Where joint assemblies change planes, provide isometric drawings depicting how components interconnect to achieve continuity.
3. Samples: For each type of exposed factory-applied finish required, prepared on Samples of size to adequately show color.
4. Research/Evaluation Reports: For roof expansion assemblies.
5. Warranties: Special warranties specified in this Section.

E. Quality Assurance
1. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.
a. Fire-Resistance Ratings: UL 2079 **OR** ASTM E 119, **as directed**.

F. Warranty
1. Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace roof expansion assemblies that leak, deteriorate in excess of rates specified in manufacturer's published product literature, or otherwise fail to perform within Two years from date of Final Completion.
2. Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied fluoropolymer finishes within 20 years from date of Final Completion.

1.2 PRODUCTS

A. Metals

1. Galvanized Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 (Z275), stretcher-leveled standard of flatness and either commercial or forming steel, minimum 0.019 inch (0.5 mm) thick.
2. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness, minimum 0.015 inch (0.4 mm) thick.
3. Copper Sheet: ASTM B 370, Temper H00 (cold rolled) unless Temper 060 is required for forming, minimum 16 oz./sq. ft. (0.55 mm thick).
4. Sheet Aluminum: ASTM B 209 (ASTM B 209M); Alloy 3003-H14, 5052-H32, or 6061-T6; minimum 0.032 inch (0.8 mm) thick.
5. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or 6063-T52, minimum 0.040 inch (1.0 mm) thick.
6. Aluminum Finishes:
   a. Mill Finish: AA-M10 (Mechanical Finish: as fabricated; no other applied finish unless buffing is required to removed scratches, welding, or grinding produced in fabrication process).
   b. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
   c. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   d. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker).
   e. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
      1) Color: As selected from manufacturer's full range.
   f. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
      1) Color and Gloss: As selected from manufacturer's full range.

B. Miscellaneous Materials
1. Roof Cement: ASTM D 4586, Type II.
2. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed,** polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and to remain watertight.
3. Mineral-Fiber Blanket: ASTM C 665.
4. Flexible Cellular Sponge or Expanded Rubber: ASTM D 1056.
5. Silicone Extrusions: Classified according to ASTM D 2000, UV stabilized, and do not propagate flame.
6. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   a. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Fire Barriers
1. Fire Barriers: Devices complying with requirements specified in Part 1.1 "Quality Assurance" Article for fire-test-response characteristics and designed for dynamic structural movement

without material degradation or fatigue when tested according to ASTM E 1399. Provide roof expansion assemblies with manufacturer's continuous, standard, flexible fire-barrier seals in back of joint system at locations indicated to provide fire-resistance rating not less than rating of adjacent construction.

D. Bellows-Type Roof Expansion Assemblies
1. Metal-Flanged, Bellows-Type Roof Expansion Assemblies: Provide manufacturer's standard assemblies of sizes and types indicated, with prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof **OR** roof-to-wall **OR** curb-to-curb **OR** curb-to-wall, **as directed,** applications.
2. Provide assemblies consisting of exposed polymeric sheet over foam bellows, securely anchored at both edges to 3- to 4-inch- (76- to 100-mm-) wide sheet metal nailing flanges, either flat or angle formed to fit cant or curbs as required. Insulate bellows with closed-cell, flexible rubber or plastic foam not less than 5/16 inch (8 mm) thick; adhere bellows to underside of polymeric sheet.
a. Polymeric Sheet: Manufacturer's standard **OR** Neoprene, 60 mils (1.5 mm) thick **OR** EPDM, 60 mils (1.5 mm) thick, black **OR** EPDM, 60 mils (1.5 mm) thick, white **OR** Reinforced chlorinated polyethylene, 30 mils (0.8 mm) thick **OR** Chlorosulfonated polyethylene, 36 mils (0.9 mm) thick **OR** Glass-reinforced PVC, 40 to 50 mils (1.0 to 1.3 mm) thick, **as directed**.
b. Metal Flanges: Zinc-coated (galvanized) steel, minimum 0.019 inch (0.5 mm) thick **OR** Copper, minimum 16 oz./sq. ft. (0.55 mm thick) **OR** Stainless steel, minimum 0.015 inch (0.4 mm) thick **OR** Sheet aluminum, minimum 0.032 inch (0.8 mm) thick, mill finish, **as directed**.
1) Mortar Flanges: Where flanges will be embedded in concrete or mortar, provide manufacturer's standard perforated-metal mortar flanges.
c. Moisture Barrier: Manufacturer's standard, flexible, continuous, polymeric moisture barrier looped under roof expansion assemblies at locations indicated. Fill space with blanket-type, mineral-fiber insulation.
d. Fire Barrier: Provide manufacturer's standard fire barrier.

E. Aluminum Roof Expansion Assemblies
1. Aluminum Roof Expansion Assemblies: Provide assemblies consisting of aluminum base members with sloped cants and provisions for anchoring and sealing to roofing membrane or flashing in a waterproof-sealed joint. Provide free-to-move, extruded-aluminum cover plate anchored against displacement and waterproofed by integral seals. Provide prefabricated units for corner and joint intersections and horizontal and vertical transitions, including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for curb-to-curb **OR** wall, **as directed,** applications.
a. Base Frame Members: Extruded aluminum with mill **OR** anodic **OR** high-performance organic, **as directed,** finish.
b. Extruded-Aluminum Covers: Minimum 0.080 inch (2.03 mm) **OR** 0.125 inch (3 mm), **as directed,** thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed,** finish.
c. Formed-Aluminum Covers: Minimum 0.078 inch (2 mm) thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed,** finish.
d. Moisture Barrier:
1) Semiconcealed, captive, polymeric sheet bellows unit of neoprene, EPDM, reinforced chlorinated polyethylene, or PVC, not less than 30 mils (0.8 mm) thick.
2) Semiconcealed, captive gaskets at both curb members, of neoprene, EPDM, or PVC, with spring-loaded mechanism to maintain positive pressure between gaskets and curb cap.
e. Fire Barrier: Provide manufacturer's standard fire barrier.

F. Seismic Roof Expansion Assemblies
1. General: Provide manufacturer's assemblies designed to accommodate seismic movement. Provide prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, inner seals, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof **OR** roof-to-wall **OR** curb-mounted, **as directed,** applications.
2. Extruded Seals: Two continuous, single-layered elastomeric profiles made of a vinyl inner seal and silicone **OR** neoprene **OR** Santoprene, **as directed,** outer seal, both seals retained in a pair of compatible extruded-aluminum frames.
   a. Exterior Seal Color: As selected from manufacturer's full range.
3. Aluminum Roof Expansion Assemblies: Assemblies consisting of pairs of aluminum curb units with sloped cants and provisions for anchoring and sealing to roofing membrane or flashing in a waterproof-sealed joint. Provide free-to-move, extruded-aluminum curb cap anchored against displacement and waterproofed by integral seals, with interior of expansion joint filled with blanket-type mineral-fiber insulation.
   a. Base Frame Members: Extruded aluminum with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed,** finish.
   b. Extruded-Aluminum Covers: Minimum 0.080 inch (2.03 mm) **OR** 0.125 inch (3 mm), **as directed,** thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed,** finish.
   c. Formed-Aluminum Covers: Minimum 0.078 inch (2 mm) thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed,** finish.
   d. Moisture Barrier:
      1) Semiconcealed, captive, polymeric sheet bellows unit of neoprene, EPDM, reinforced chlorinated polyethylene, or PVC, not less than 30 mils (0.8 mm) thick.
      2) Semiconcealed, captive gaskets at both curb members, of neoprene, EPDM, or PVC, with spring-loaded mechanism to maintain positive pressure between gaskets and curb cap.
   e. Fire Barrier: Provide manufacturer's standard fire barrier.

1.3 EXECUTION

A. Installation
1. Comply with manufacturer's written instructions for handling and installing roof expansion assemblies and materials unless more stringent requirements are indicated.
2. Coordinate installation of roof expansion assembly materials and associated work so complete assemblies comply with assembly performance requirements.
3. Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of roof expansion assembly, including transitions and end joints.
4. Extend roof expansion assemblies over curbs, parapets, cornices, gutters, valleys, fasciae, and other elements in the construction profile, with factory-fabricated intersections and transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.
   a. Install factory-fabricated transitions between roof expansion assemblies and building architectural joint systems, specified in Division 07 Section "Expansion Control", to provide continuous, uninterrupted, watertight construction.
5. Splice roof expansion assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.
6. Provide uniform profile of roof expansion assembly throughout length of each installation; do not stretch polymeric sheets.
7. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.
8. Bed anchorage flanges in cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer but not less than 6 inches (150 mm) o.c.

9. Anchor roof expansion assemblies complying with manufacturer's written instructions.
10. Embed flanges not less than 4 inches (100 mm) in bituminous membranes, with hot bitumen or roof cement. Cover with stripping material and install according to requirements in roofing section.
11. On single-ply roofing, install roof expansion assemblies complying with manufacturer's written instructions. Anchor to cants or curbs and seal to membrane with sealant compatible with roofing membrane and roof expansion assembly. Cover flanges with stripping or flashing and install according to requirements in roofing section.

B. Protection
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that roof expansion assemblies are without damage or deterioration at time of Final Completion.

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Task	Specification	Specification Description
07 95 13 16	07 95 13 13	Architectural Joint Systems

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Task	Specification	Specification Description
08 01 44 00	01 22 16 00	No Specification Required

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SECTION 08 01 52 61 - WOOD WINDOWS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for wood windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes fixed and operable wood-framed windows of the following type:
   a. Unfinished.
   b. Aluminum clad.
   c. Vinyl clad.

C. Definitions
1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
   a. AW: Architectural.
   b. HC: Heavy Commercial.
   c. C: Commercial.
   d. LC: Light Commercial.
   e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
   a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements
1. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size required by AAMA/WDMA 101/I.S.2/NAFS.
2. Structural Performance: Provide wood windows capable of withstanding the effects of the following loads based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
   a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
      2) Importance Factor: I **OR** II **OR** III **OR** IV, **as directed**.
      3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
   b. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.

E. Submittals
1. Product Data: For each type of wood window indicated.
2. LEED Submittal:
   a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood windows comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
      1) Include statement indicating costs for each certified wood product.
3. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details.
4. Samples: For each exposed finish.
5. Product Schedule: Use same designations indicated on Drawings.
6. Product test reports.
7. Maintenance data.

F. Quality Assurance
1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Manufacturer Qualifications: A qualified manufacturer who is certified for chain of custody by an FSC-accredited certification body.
3. Forest Certification: Provide windows made with not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   a. Provide AAMA-certified **OR** WDMA-certified, **as directed**, wood windows with an attached label.
5. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
6. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
   a. Warranty Period:
      1) Window: Two **OR** Three, **as directed**, years from date of Final Completion.
      2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
      3) Metal Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
2. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, and not less than 16,000-psi (110-MPa) minimum yield strength.
   a. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

b. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
c. Baked-Enamel Finish for Extrusions and Sheet: Manufacturer's standard baked enamel complying with AAMA 2603 and paint manufacturer's written specifications for cleaning, conversion coating, and painting.
1) Color: White **OR** Bronze **OR** Brown **OR** Beige **OR** Gray **OR** Green **OR** As selected from manufacturer's full range **OR** Custom color as selected, **as directed**.
d. High-Performance Organic Finish for Extrusions and Sheet: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.
a) Color and Gloss: As selected from manufacturer's full range.
e. Baked-Enamel Finish for Coil: Manufacturer's standard baked enamel complying with AAMA 620 and paint manufacturer's written specifications for cleaning, conversion coating, and painting.
1) Color: White **OR** Bronze **OR** Brown **OR** Beige **OR** Gray **OR** Green **OR** As selected from manufacturer's full range **OR** Custom color as selected, **as directed**.

3. Vinyl for Cladding: Consisting of a rigid PVC sheath, made from PVC complying with ASTM D 4726, not less than 35-mil (0.9-mm) average thickness, in permanent, integral color, white **OR** bronze **OR** tan, **as directed**, finish, mechanically bonded to exterior wood sash and frame members.
4. Wood Trim and Glazing Stops: Material and finish to match frame members.
5. Clad Trim and Glazing Stops: Hollow extrusions **OR** Roll-formed sheet material **OR** Clad-wood material, **as directed**, and finish to match clad frame members.
6. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components.
a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
7. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
8. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
9. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when wood window is closed.
a. Weather-Stripping Material:
1) Elastomeric cellular preformed gaskets complying with ASTM C 509.
2) Dense elastomeric gaskets complying with ASTM C 864.
3) Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
10. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
11. Replaceable Weather Seals: Comply with AAMA 701/702.

B. Window
1. Window Type: Casement **OR** Double hung **OR** Fixed **OR** Horizontal sliding **OR** Projected awning **OR** Single hung **OR** Bay **OR** Bow **OR** Specialty product **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
2. AAMA/WDMA Performance Requirements: Provide wood windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
   a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
   b. Performance Class and Grade: LC25 **OR** 30 **OR** 35, **as directed**.
   c. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
   d. Performance Class and Grade: HC40 **OR** 45 **OR** 50, **as directed**.
   e. Performance Class and Grade: AW40 **OR** 45 **OR** 50, **as directed**.
   f. Performance Class and Grade: As indicated.
3. Condensation-Resistance Factor (CRF): Provide wood windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52, **as directed**.
4. Thermal Transmittance: Provide wood windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed**.
   a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
5. Solar Heat-Gain Coefficient (SHGC): Provide wood windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
7. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
   a. Maximum Rate:
      1) 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa) which is equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes.
      2) 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind speed and is typically used to test HC and AW performance classes.
   b. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
   c. Test Pressure:
      1) 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
      2) 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
8. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
9. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
10. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

C. Glazing
1. Glass and Glazing Materials: Refer to Division 08 Section "Glazing"" for glass units and glazing requirements applicable to glazed wood window units.
2. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units,

argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".

3. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed**.
4. Dual-Glazing System for Venetian Blinds: Manufacturer's standard dual-glazing system with 2 lites of clear float glass, complying with ASTM C 1036, Type I, Quality q3, glazed independently into the sash and separated by a minimum dead-air space of 1-1/2 inches (38 mm).
5. Triple-Glazing System for Venetian Blinds: Manufacturer's standard insulated glass of type specified, combined with an auxiliary lite of clear float glass, complying with ASTM C 1036, Type I, Quality q3, retained in a separate glazing channel or frame and separated from insulated-glass unit by a minimum dead-air space of 1-1/2 inches (38 mm).

D. Hardware
1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with wood and aluminum cladding, **as directed**; designed to smoothly operate, tightly close, and securely lock wood windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.
2. Counterbalancing Mechanism: Comply with AAMA 902.
   a. Sash-Balance Type: Concealed, tape-spring **OR** spiral-tube **OR** spring-loaded, block-and-tackle, **as directed**, type, of size and capacity to hold sash stationary at any open position.
3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks, **as directed**.
5. Roller Assemblies: Low-friction design.
6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
   a. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
   a. Locking mechanism and handles for manual operation.
   b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.
9. Limit Devices: Provide concealed friction adjustor, adjustable stay bar **OR** concealed support arms with adjustable, limited, hold-open, **as directed**, limit devices designed to restrict sash or ventilator opening.
   a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.

E. Insect Screens
1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully

integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.

a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.

2. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
   a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
   b. Finish:
      1) Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color **OR** in color selected from manufacturer's full range, **as directed**.
         OR
         Manufacturer's standard.
3. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.
   a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
4. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
   a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
5. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.

F. Accessories
1. Dividers (False Muntins): Provide dividers in designs indicated for each sash lite, one per sash, removable from the exposed surface of interior lite of the sash **OR** two per sash, removable from the exposed surfaces of interior and exterior lites of the sash, **as directed**, and one permanently located between glazing lites in the airspace, **as directed**.
   a. Material: Extruded, rigid PVC **OR** Prefinished wood, **as directed**.
   b. Design: Rectangular **OR** Diamond, **as directed**.
   c. Color: White **OR** Bronze, **as directed**.
2. Storm Panels: Provide removable auxiliary glazing panels of clear float glass for each fixed and operating sash of window units. Glass shall comply with ASTM C 1036, Type I, Quality q3. Provide glass of thickness required to comply with requirements in Division 08 Section "Glazing". Frame, preglaze, and attach storm windows to the sash according to manufacturer's published standards. Omit storm panels on sash glazed with insulating glass, **as directed**.
3. Integral Louver Blinds: Provide remotely operated horizontal louver blinds in the space between two panes of glass. Construct blinds of aluminum slats, approximately 1 inch (25 mm) wide, with polyester fiber cords, equipped for tilting, raising, and lowering by standard operating hardware located on inside face of sash.

G. Fabrication
1. Fabricate wood windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
2. Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
   a. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.
4. Factory machine windows for openings and for hardware that is not surface applied.
5. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances

and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

6. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze wood windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
7. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
8. Bow **OR** Bay, **as directed**, Windows: Provide wood windows in configuration indicated. Provide window frames, fixed and operating sash, operating hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
   a. Angled mullion posts with interior and exterior trim.
   b. Angled interior and exterior extension and trim.
   c. Clear pine head and seat boards.
   d. Top and bottom plywood platforms.
   e. Exterior head and sill casings and trim.
   f. Support brackets.
9. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

H. Wood Finishes
1. Factory-Primed Windows: Provide manufacturer's standard factory-prime coat complying with WDMA T.M. 11 on exposed exterior **OR** interior **OR** exterior and interior, **as directed**, wood surfaces.
2. Factory-Finished Windows: Provide manufacturer's standard factory finish complying with WDMA T.M. 12. Apply finish to exposed exterior and interior wood surfaces.
   a. Color: White **OR** Brown **OR** Gray **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation
1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

B. Adjusting, Cleaning, And Protection
1. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
2. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 01 52 61

Task	Specification	Specification Description
08 01 81 00	07 42 13 19	Glazing

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SECTION 08 05 13 00 - STEEL DOORS AND FRAMES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for steel doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Standard hollow metal doors and frames.
b. Custom hollow metal doors and frames.

C. Definitions
1. Minimum Thickness: Minimum thickness of base metal without coatings.
2. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
3. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
3. Samples for Verification: For each type of exposed finish required.
4. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.
5. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

E. Quality Assurance
1. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5, **as directed**, or UL 10B**OR** UL 10C, **as directed**.
a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9 **OR** IBC Standard 716.5, **as directed**. Label each individual glazed lite.
3. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784 **OR** IBC Standard 716.5, **as directed**.

F. Delivery, Storage, And Handling

1. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   a. Provide additional protection to prevent damage to finish of factory-finished units.
2. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
3. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
   a. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.2 PRODUCTS

A. Materials
1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) **OR** G60 (Z180) or A60 (ZF180), **as directed**, metallic coating.
4. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
   a. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
5. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
6. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
7. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
8. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
9. Glazing: Comply with requirements in Division 08 Section "Glazing".
10. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

B. Standard Hollow Metal Doors
1. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
   a. Design: Flush panel **OR** Embossed panel **OR** As indicated, **as directed**.
   b. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
      1) Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
      2) Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) **OR** 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W), **as directed**, when tested according to ASTM C 1363.
         a) Locations: Exterior doors and interior doors where indicated, **as directed**.

c. Vertical Edges for Single-Acting Doors: Beveled edge **OR** Square edge **OR** Manufacturer's standard, **as directed**.
   1) Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
d. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
e. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
f. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

2. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   a. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
      1) Width: 1-3/4 inches (44.5 mm) **OR** 1-3/8 inches (34.9 mm) **OR** As indicated on Drawings, **as directed**.
   b. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
   c. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless) **OR** Model 3 (Stile and Rail), **as directed**.
   d. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
3. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   a. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
      1) Width: 1-3/4 inches (44.5 mm) **OR** 1-3/8 inches (34.9 mm) **OR** As indicated on Drawings, **as directed**.
   b. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
   c. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless) **OR** Model 3 (Stile and Rail), **as directed**.
   d. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
4. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
5. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

C. Standard Hollow Metal Frames
1. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
2. Exterior Frames: Fabricated from metallic-coated steel sheet.
   a. Fabricate frames with mitered or coped corners.
   b. Fabricate frames as knocked down **OR** face welded **OR** full profile welded, **as directed,** unless otherwise indicated.
   c. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
   d. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
   e. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
   f. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
3. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
   a. Fabricate frames with mitered or coped corners.
   b. Fabricate frames as knocked down **OR** face welded **OR** full profile welded, **as directed**, unless otherwise indicated.
   c. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions**, as directed**.

d. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
e. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
f. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
g. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
h. Frames for Wood Doors: 0.042-inch- (1.0-mm-) **OR** 0.053-inch- (1.3-mm-) **OR** 0.067-inch- (1.7-mm-), **as directed**, thick steel sheet.
i. Frames for Borrowed Lights: 0.042-inch- (1.0-mm-) thick steel sheet **OR** 0.053-inch- (1.3-mm-) thick steel sheet **OR** 0.067-inch- (1.7-mm-) thick steel sheet **OR** Same as adjacent door frame, **as directed**.

4. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

D. Custom Hollow Metal Doors
1. General: Provide doors not less than 1-3/4 inches (44.5 mm) thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. Comply with ANSI/NAAMM-HMMA 861.
2. Exterior Door Face Sheets: Fabricated from metallic-coated steel sheet, minimum 0.053 inch (1.3 mm) thick.
3. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated, minimum 0.042 inch (1.0 mm) thick.
4. Core Construction: Provide thermal-resistance-rated cores for exterior doors and interior doors where indicated, **as directed**.
   a. Steel-Stiffened Core: 0.026-inch- (0.7-mm-) thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart, spot welded to face sheets a maximum of 5 inches (127 mm) o.c. Spaces filled between stiffeners with glass- or mineral-fiber insulation.
      1) Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
      2) Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W), **as directed,** when tested according to ASTM C 1363.
5. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches (3 mm in 50 mm).
6. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
7. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 inch (1.3 mm) thick, of same material as face sheets and spot welded to both face sheets.
8. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as door face sheets.

E. Custom Hollow Metal Frames
1. General: Fabricate frames of construction indicated. Close contact edges of corner joints tight with faces mitered and stops butted or mitered. Continuously weld faces and soffits and finish faces smooth. Comply with ANSI/NAAMM-HMMA 861.
   a. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricated from 0.053-inch- (1.3-mm-) thick steel sheet.
   b. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricated from 0.067-inch- (1.7-mm-) thick steel sheet.
   c. Sidelight and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   d. Borrowed-Light Frames: Fabricated from 0.053-inch- (1.3-mm-) thick steel sheet.
2. Exterior Frames: Formed from metallic-coated steel sheet.
3. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
4. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as frame.

5. Head Reinforcement: Provide minimum 0.093-inch- (2.3-mm-) thick, steel channel or angle stiffener for opening widths more than 48 inches (1219 mm).

F. Frame Anchors
1. Jamb Anchors:
   a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
   b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
   c. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
   d. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
2. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
   a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

G. Hollow Metal Panels
1. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

H. Stops And Moldings
1. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
2. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
3. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.
4. Terminated Stops: Where indicated on interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 45-degree **OR** 90-degree, **as directed**, angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

I. Louvers
1. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
   a. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
   b. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
   c. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

J. Accessories
1. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
2. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
3. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

K. Fabrication
1. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
2. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117 **OR** ANSI/NAAMM-HMMA 861, **as directed**.
3. Hollow Metal Doors:
   a. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   b. Glazed Lites: Factory cut openings in doors.
   c. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
4. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   a. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   b. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   c. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   d. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   e. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   f. Jamb Anchors: Provide number and spacing of anchors as follows:
      1) Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         a) Two anchors per jamb up to 60 inches (1524 mm) high.
         b) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
         c) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
         d) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
      2) Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         a) Three anchors per jamb up to 60 inches (1524 mm) high.
         b) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
         c) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
         d) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
         e) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
      3) Compression Type: Not less than two anchors in each jamb.
      4) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
   g. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
      1) Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      2) Double-Door Frames: Drill stop in head jamb to receive two door silencers.

5. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
6. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware".
   a. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 **OR** ANSI/NAAMM-HMMA 861.
   b. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
   c. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   d. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26.
7. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   a. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
   b. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   c. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   d. Provide loose stops and moldings on inside of hollow metal work.
   e. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

L. Steel Finishes
1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
   a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation
1. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
2. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 **OR** HMMA 840, **as directed**.
   a. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      1) At fire-protection-rated openings, install frames according to NFPA 80.
      2) Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      3) Install frames with removable glazing stops located on secure side of opening.
      4) Install door silencers in frames before grouting.
      5) Remove temporary braces necessary for installation only after frames have been properly set and secured.
      6) Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

7) Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

b. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

c. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

d. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

e. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

f. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

g. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

h. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

i. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
1) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
a. Non-Fire-Rated Standard Steel Doors:
1) Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
2) Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
3) Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
4) Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
b. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
c. Smoke-Control Doors: Install doors according to NFPA 105 **OR** IBC Standard 716.5, **as directed**.

4. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

B. Adjusting And Cleaning
1. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
2. Remove grout and other bonding material from hollow metal work immediately after installation.

3. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
4. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 05 13 00

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SECTION 08 05 13 00a - FLUSH WOOD DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for flush wood doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Solid-core doors and transom panels with wood-veneer, medium-density-overlay, hardboard or MDF, and plastic-laminate faces.
b. Hollow-core doors with wood-veneer, hardboard or MDF, and plastic-laminate faces.
c. Shop priming and Factory finishing flush wood doors.
d. Factory fitting flush wood doors to frames and factory machining for hardware.

C. Submittals
1. Product Data: For each type of door indicated. Include factory-finishing specifications.
2. LEED Submittals:
a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
1) Include statement indicating costs for each certified wood product.
b. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
a. Indicate dimensions and locations of mortises and holes for hardware.
b. Indicate dimensions and locations of cutouts.
c. Indicate requirements for veneer matching.
d. Indicate doors to be factory finished and finish requirements.
e. Indicate fire-protection ratings for fire-rated doors.
4. Samples: For plastic-laminate door faces and factory-finished doors.

D. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated" **OR** WDMA I.S.1-A, "Architectural Wood Flush Doors" **OR** WI's "Manual of Millwork", **as directed**.
3. Forest Certification: Provide doors made with cores **OR** veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B **OR** UL 10C, **as directed**.
a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

5. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Comply with requirements of referenced standard and manufacturer's written instructions.
2. Package doors individually in plastic bags or cardboard cartons **OR** cardboard cartons and wrap bundles of doors in plastic sheeting, **as directed**.
3. Mark each door on bottom **OR** top and bottom, **as directed**, rail with opening number used on Shop Drawings.

F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
a. Warranty Period for Solid-Core Exterior Doors: Two **OR** Five, **as directed**, years from date of Final Completion.
b. Warranty Period for Solid-Core Interior Doors: Life of installation.
c. Warranty Period for Hollow-Core Interior Doors: One **OR** Two, **as directed**, year(s) from date of Final Completion.

1.2 PRODUCTS

A. Door Construction, General
1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
2. WDMA I.S.1-A Performance Grade:
a. Heavy Duty unless otherwise indicated.
b. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits, patient rooms, and where indicated.
c. Standard Duty: Closets (not including janitor's closets), private toilets, and where indicated.
3. Particleboard-Core Doors:
a. Particleboard:
1) ANSI A208.1, Grade LD-1 **OR** Grade LD-2, **as directed**, made with binder containing no urea-formaldehyde resin, **as directed**.
OR
Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
b. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
c. Provide doors with glued-wood-stave **OR** structural-composite-lumber, **as directed**, cores instead of particleboard cores for doors indicated to receive exit devices.
4. Structural-Composite-Lumber-Core Doors:
a. Structural Composite Lumber: WDMA I.S.10.
1) Screw Withdrawal, Face: 700 lbf (3100 N).
2) Screw Withdrawal, Edge: 400 lbf (1780 N).
5. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
a. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

b. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals, **as directed**. Comply with specified requirements for exposed edges.
OR
Pairs: Provide formed-steel edges and astragals with intumescent seals, **as directed**.
1) Finish steel edges and astragals with baked enamel same color as doors, **as directed**.
OR
Finish steel edges and astragals to match door hardware (locksets or exit devices).

6. Mineral-Core Doors:
   a. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   b. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
   c. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
7. Hollow-Core Doors:
   a. Construction: Institutional **OR** Standard, **as directed**, hollow core.

B. Veneered-Faced Doors For Transparent Finish
1. Exterior Solid-Core Doors:
   a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
   b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
   c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
   d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
   e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.
   f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
   g. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
   h. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber**, as directed**.
   i. Construction: Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
   j. Adhesives: Type I per WDMA TM-6.
2. Interior Solid-Core Doors:
   a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
   b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
   c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
   d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
   e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.

f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
g. Room Match:
1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) **OR** 20 feet (6 m), **as directed**, or more.
OR
Provide door faces of compatible color and grain within each separate room or area of building.
h. Transom Match: Continuous match **OR** End match **OR** As indicated, **as directed**.
i. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Division 06 Section(s) "Interior Architectural Woodwork" OR "Wood Paneling", **as directed**.
j. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
k. Core: Particleboard **OR** Glued wood stave **OR** Nonglued wood stave **OR** Structural composite lumber**, as directed**.
l. Construction:
1) Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
OR
Seven plies, either bonded or nonbonded construction.

3. Interior Hollow-Core Doors:
a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.
f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
g. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
h. Construction: Seven plies.

C. Doors For Opaque Finish
1. Exterior Solid-Core Doors:
a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option, **as directed**.
1) Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers **OR** directly to high-density hardboard crossbands, **as directed**.
c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
d. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.

e. Construction: Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
f. Adhesives: Type I per WDMA TM-6.

2. Interior Solid-Core Doors:
a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option **OR** Hardboard or MDF, **as directed**.
1) Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers **OR** directly to high-density hardboard crossbands, **as directed**.
2) Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
3) MDF Faces: ANSI A208.2, Grade 150 or 160.
c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
d. Core: Particleboard **OR** Glued wood stave **OR** Nonglued wood stave **OR** Structural composite lumber, **as directed**.
e. Construction:
1) Three **OR** Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
OR
Three **OR** Seven, **as directed**, plies, either bonded or nonbonded construction.

3. Interior Hollow-Core Doors:
a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option **OR** Hardboard or MDF, **as directed**.
1) Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
2) MDF Faces: ANSI A208.2, Grade 150 or 160.
c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
d. Construction: Three **OR** Seven, **as directed**, plies.

D. Plastic-Laminate-Faced Doors
1. Interior Solid-Core Doors:
a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS **OR** Grade HSH, **as directed**.
c. Colors, Patterns, and Finishes: As indicated **OR** As selected from laminate manufacturer's full range of products, **as directed**.
d. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Hardwood edges for staining to match faces **OR** Hardwood edges for painting **OR** Plastic laminate that matches faces, applied before faces **OR** Impact-resistant polymer edging, applied after faces, **as directed**.
1) Polymer Edging Color: Beige **OR** Brown **OR** Same color as faces, **as directed**.
e. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.
f. Construction:
1) Three plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces are applied. Faces are bonded to core using a hot press, **as directed**.
OR
Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press, **as directed**.

2. Interior Hollow-Core Doors:
a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS **OR** Grade HSH, **as directed**.
c. Colors, Patterns, and Finishes: As indicated **OR** As selected from laminate manufacturer's full range of products, **as directed**.

d. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Hardwood edges for staining to match faces **OR** Hardwood edges for painting **OR** Plastic laminate that matches faces, applied before faces **OR** Impact-resistant polymer edging, applied after faces, **as directed**.
   1) Polymer Edging Color: Beige **OR** Brown **OR** Same color as faces, **as directed**.
e. Construction: Plastic-laminate faces glued directly to core.

E. Louvers And Light Frames
1. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
   a. Wood Species: Same species as door faces **OR** Species compatible with door faces **OR** Any closed-grain hardwood, **as directed**.
2. Metal Louvers:
   a. Blade Type: Vision-proof, inverted V **OR** Vision-proof, inverted Y **OR** Darkroom-type, double inverted V, **as directed**.
   b. Metal and Finish:
      1) Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**.
         OR
         Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
         OR
         Extruded aluminum with light bronze **OR** medium bronze **OR** dark bronze **OR** black, **as directed**, Class II, color anodic finish, AA-M12C22A32/A34.
3. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
   a. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**.
4. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
   a. Wood Species: Same species as door faces **OR** Species compatible with door faces **OR** Any closed-grain hardwood, **as directed**.
   b. Profile: Flush rectangular beads **OR** Recessed tapered beads **OR** Recessed tapered beads with exposed banding **OR** Lipped tapered beads **OR** Manufacturer's standard shape, **as directed**.
   c. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
5. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
6. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**; and approved for use in doors of fire-protection rating indicated.

F. Fabrication
1. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   a. Comply with requirements in NFPA 80 for fire-rated doors.
2. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   a. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   b. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

3. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
   a. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, **as directed**, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
4. Openings: Cut and trim openings through doors in factory.
   a. Light Openings: Trim openings with moldings of material and profile indicated.
   b. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing".
   c. Louvers: Factory install louvers in prepared openings.
5. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming **OR** factory finishing, **as directed**.
   a. Flash top of outswinging doors (with manufacturer's standard metal flashing).

G. Shop Priming
1. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting", **as directed**. Seal all four edges, edges of cutouts, and mortises with primer.
2. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting" OR "Staining And Transparent Finishing", **as directed**. Seal all four edges, edges of cutouts, and mortises with first coat of finish.

H. Factory Finishing
1. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   a. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom **OR** top and bottom, **as directed**, edges, edges of cutouts, and mortises.
2. Finish doors at factory.
   OR
   Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
   OR
   Finish doors at factory where indicated in schedules or on Drawings as factory finished.
3. Transparent Finish:
   a. Grade: Premium **OR** Custom, **as directed**.
   b. Finish:
      1) AWI conversion varnish **OR** catalyzed polyurethane, **as directed**, system.
         OR
         WDMA TR-4 conversion varnish **OR** TR-6 catalyzed polyurethane, **as directed**.
         OR
         WI System 4 clear conversion varnish **OR** 5 catalyzed polyurethane **OR** 8 UV-curable coating, **as directed**.
   c. Staining: Match sample **OR** As selected from manufacturer's full range **OR** None required, **as directed**.
   d. Effect: Open-grain finish **OR** Filled finish **OR** Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores, **as directed**.
   e. Sheen: Satin **OR** Semigloss, **as directed**.
4. Opaque Finish:
   a. Grade: Premium **OR** Custom, **as directed**.
   b. Finish:
      1) AWI conversion varnish **OR** catalyzed polyurethane, **as directed**, system.
         OR
         WDMA OP-4 conversion varnish **OR** OP-6 catalyzed polyurethane, **as directed**.

OR
WI System 4 conversion varnish **OR** 5 catalyzed polyurethane **OR** 8 UV-curable coating, **as directed**.

c. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.
d. Sheen: Satin **OR** Semigloss **OR** Gloss, **as directed**.

1.3 EXECUTION

A. Installation
1. Hardware: For installation, see Division 08 Section "Door Hardware".
2. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
a. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
3. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
a. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
1) Comply with NFPA 80 for fire-rated doors.
b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
4. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
5. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

B. Adjusting
1. Operation: Rehang or replace doors that do not swing or operate freely.
2. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 05 13 00a

Task	Specification	Specification Description
08 05 13 00	01 22 16 00	No Specification Required
08 05 13 00	06 48 13 00	Wood Doors
08 05 13 00	08 34 73 16	Sound Control Doors

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SECTION 08 11 63 13 - STEEL STORM DOORS

DESCRIPTION OF WORK

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

GENERAL

Definitions

1. Supply and Delivery only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

System Description

2. Performance Requirements: Comply with following:
   a. Steel Storm Doors: Largest steel storm door size: Meet or exceed performance requirements of Section 2.1 (CSD-1) of ANSI/AAMA 1102.7 and ASTM B 117.
   b. Steel Storm Doors: Completely assembled storm door measuring at least 914 mm (36 inches) wide x 2 032 mm (80 inches) high with necessary braces and hardware:
      1) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.
      2) Forced Entry Resistance Test: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.3 for Heavy Type.
      3) Storm Door Screen Insert: Completely assembled screen of 914 mm (36 inches) by 1 524 mm (60 inches) size with necessary braces: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.1 Impact Test performance requirements for Medium Type.
   c. Steel Screen Doors: Completely assembled screen door measuring at least 914 mm (36 inches) wide by 2 032 mm (80 inches) high with necessary braces and hardware:
      1) Impact Test: Meet or exceed performance requirements of ANSI/SMA 6001 Paragraph 4.2.4.1 for Medium Type.
      2) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.
   d. Door Finish: Subjected to ASTM B117 Salt Spray Fog Test for minimum of 250 hours. Cut tubular section open to check finish performance.

Submittals

3. Product Data.
4. Shop Drawings:
   a. Include exploded view of manufactured door, similar to ANSI/AAMA 1102.7, page 12.
   b. Indicate fabrication of all parts, metal thickness, installation details, fastening, and sealing.
   c. Include sections of typical members and details of latching devices.
5. Samples: Submit full set of finish color samples for color selection.
   a. For Supply and Deliver Only Contract: Submit one full size sample of each type of storm door with specified finish for acceptance.
6. Quality Assurance/Control Submittals:
   a. Certificates: Manufacturer's written third party certification that storm doors meet or exceed ANSI/AAMA 1102.7 (CSD-1), Paragraph 2.1.6.5 of ANSI/SMA 6001, ASTM B117, and other specified requirements.
   b. Manufacturer's installation instructions.
7. Closeout Submittals:
   a. Operation and maintenance data.
   b. Special warranty.

Quality Assurance

8. Regulatory Requirements: Comply with following:
   a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
   b. Accessibility:
      1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
         a) Uniform Federal Accessibility Standards (UFAS).
      2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
      3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
      4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
9. Certifications: Comply with ANSI Z34.2.
10. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of storm door with specified finish for acceptance.
    a. Location: As directed.
    b. Approved Mock-up: Standard for rest of work.
    c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

11. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
    a. Screens: Label attached signifying compliance with ANSI/AAMA 1102.7 (CSD-1), ANSI/SMA 6001, ASTM B 117 performance requirements.
       1) Labels: Include manufacturers name and code identifying plant location and validation date.
       2) Labels: Affixed to inside of vertical member of each door.
12. Acceptance at Site: Inspect storm doors upon delivery. Replace damaged or defective materials before installation.
13. Storage and Protection: Store storm doors in manner to protect from weather and other damage.

Project Conditions

14. Field Measurements: Field measure openings for storm doors before start of fabrication.

Scheduling And Sequencing

15. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

16. Special Warranty: Provide one year written covering materials and installation for storm doors.
    a. Warranty: Include coverage of inserts, closers, chains, hardware, and latches.
       1) Screening and glazing not included.
       2) Defects resulting from vandalism not included.
    b. For Supply and Delivery Only Contract:
       1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
       2) Contractor: Agrees to supply and deliver free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
    c. For Supply and Install Contract:
       1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement door.

PRODUCTS

Steelstorm Doors

17. Storm Doors: Type(s) and size(s) indicated, specified, or scheduled manufactured of steel and provided with pro-hung aluminum frame liner (Z-bar) to fit entrance door apertures requiring frame sizes of 762 mm (30 inches) to 940 mm (37 inches) in width and 2 007 mm (79 inches) to 2 134 mm (84 inches) in height.
    a. Storm Doors: Complete with Z-bar frame liner, glazing, replaceable screen insert, durable steel kick plate, adjustable sill sweep, and necessary hardware.
    b. Assembly: Secure and workmanlike manner permitting storm door to perform properly and assuring its neat and weather-resistant construction.
18. Materials:
    a. Master Frame: Minimum 22 gage (0.85 mm) roll formed steel, or 16 gage (1.6 mm) tubular steel as applicable to item specified.
    b. Fasteners: Stainless, cadmium plated, or zinc-plated steel screws, nuts, washers, bolts and other miscellaneous fastening devices and hardware in accordance with ASTM B 633 or ASTM B 766.
    c. Kick Plate: Minimum 18 gage (1.3 mm) embossed galvanized panel for roll formed frame or 16 gage (1.6 mm) flat galvanized steel sheet for tubular steel frame.
    d. Screen Insert:
        1) Screening: ANSI/SMA 6001, Paragraph 4.2.4.1, Medium Type, 12 x 12 stainless steel, at least 0.58 mm (0.023 inch) diameter.
        2) Screen Frame: Roll formed or tubular lock seam type formed from not less than 25 gage (0.53 mm) hot dipped galvanized steel or extruded aluminum.
    e. Glazing Bead, Storm Door Sweep and Screen Spline: Polyvinyl chloride (PVC) or equal material
    f. Frame Liner (Z-bar): Extruded aluminum, 6063 J5.
    g. Weatherstripping: Wool pile, or vinyl.
19. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
    a. Tempered Glass: ASTM C 1048, Kind FT. Condition A, Type 1, Class 1, Glazing B Quality.
    b. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
        1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
        2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum 340,000 PSI.
        3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
        4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
    c. Glass Thickness: In accordance with ANSI/AAMA 1002.10 Appendix, minimum 5 mm (3/16 inch).
        1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
    d. Glass: Labeled to show name of manufacturer and type.
    e. Glazing Material: Installed in rigid removable steel or extruded aluminum subframe.
20. Construction:
    a. Master Frame: Roll Formed tubular lock-seam construction formed from 22 gage (0.85 m) hot dipped galvanized steel.
        1) Comers: Either mitered or butt-jointed and rigidly fastened together by brazing or welding. Insert steel gussets at comers of mitered or butt-jointed storm doors when edge brazing is used.
        2) Welded tubular galvanized steel of 16 gage (1.6 mm) wall thickness is not required to use comer blocks or gussets.
    b. Transom Rail (mullion): Accurately machined or accurately fit frame and rigidly welded to side of stiles.
        1) Kick Plate: Rigidly retained in place by steel or aluminum spline.
    c. Glazing Frames: Mitered joints with comer gussets securely staked or brazed at comers.
        1) Inserts: Securely held in door.
        2) Provide positive contact between inserts and master frame to stop passage of insects and to prevent rattling.

d. Screen Inserts: Constructed to withstand performance requirements of ANSI/SMA 6001, Heavy Type.
   1) Screen Frames: Rolled, tubular lock seam construction or extruded aluminum.
e. Adjustable Expander: Installed at bottom of each storm door to receive vinyl sweep.
   1) Adjustment Limit: Minimum 7.9 mm (5/16 inch).
   2) Vinyl Door Sweep: Installed in entire length of expander.
f. Frame Liner (Z-bar): Track to receive weather stripping and necessary installation holes.
   1) Head Section of Frame Liner: Formed to function as drip cap.

21. Dimensions:
    a. Widths across Master Frames:
       1) For Roll Form Door Minimum 70 mm (2-3/4 inches).
       2) For Tubular Doors: Minimum 51 mm (2 inches) with 23.7 mm (15/16 inch) minimum thickness.
    b. Mullion Bar Following minimum widths across:
       1) Roll Form Door 48 mm (1-7/8 inches).
       2) Tubular Door: 23.7 mm (15/16 inch). Frame Liner: Minimum 27 mm (1-1/16 inch) return offset on outside face for side flange width for bearing against door buck. Wall Thickness of Frame Liner: Minimum 1.57 mm (0.062 inch). Storm Door: Supported by adequate reinforcing ribs.
    c. Insert Frame: Maximum 4.8 mm (1/8 inch) overall clearance in width and height and interchangeable in storm doors having same nominal size.
    d. Master Frame Dimensions: Manufacturing tolerance of plus or minus 4.8 mm (1/8 inch).
22. Hardware: Stainless steel, aluminum or other non-corrosive material.
    a. Cadmium or Zinc Plated Steel: ASTM B 633 or ASTM B 766.
    b. Include latch equipped with exterior handle, interior locking mechanism with anti-lockout feature, adjustable heavy duty door closer, necessary screws, and hurricane chain with spring.
    c. Hinges: Install one of following hinge types on each frame liner and storm door:
       1) At least 4 concealed 304 stainless steel hinges on bronze oilite bearings, each minimum 75 mm (3 inches) long.
       2) At least 3 surface-mounted (H) type galvanized steel hinges.

Accessories

23. Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.

Finishes

24. Finish: Baked enamel or polyester poly powder coat applied to phosphatized, zinc impregnated or coated hot dipped galvanized steel.
    a. Finish: Not show fading or corrosion when exposed to salt-spray test specified in this Section.

Source Quality Control

25. Testing: Performed by accredited independent testing laboratory.

EXECUTION

Examination

26. Site Verification of Conditions:
    a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
    b. Existing Conditions: Examine openings before beginning installation.
    c. Verify that surfaces to receive storm doors are clean.

Preparation

27. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
    a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
    b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
28. Existing Storm Doors: Remove existing screen and storm doors and debris from site in accordance with Detailed Scope of Work.
29. Prime Door Jambs of Existing Prime Doors: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of steel storm doors.
    a. Preparatory Work: Include, but not limited to repair of iambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

30. General: Install in accordance with ASTM E 737, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
    a. Securely fasten doors in place to straight, plumb and level condition, without distortion of door or door frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
    b. In high wind areas, install storm door hinges on side to prevailing wind as directed.
31. Joint Sealants: Apply in accordance with manufacturers recommendations.
    a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
    b. Prime cleaned surfaces in accordance with sealant manufacturers recommendations.
    c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
    d. Seal joints between perimeter of door frame and underlying or surrounding construction with joint sealant to accomplish weather-tight installation.
    e. Maximum Width of Sealed Joint: 13 mm (1/2 inch).
32. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
    a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.

Adjusting And Cleaning

33. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave storm doors and hardware in proper operating condition.
34. Cleaning: Comply with requirements of Detailed Scope of Work.
    a. Clean storm doors after installation is completed to remove foreign matter and surface blemishes.
    b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

35. Installed Work: Protect storm doors from damage after installation.

END OF SECTION 08 11 63 13

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SECTION 08 11 63 13a - SECURITY WINDOW SCREENS AND DOORS

DESCRIPTION OF WORK

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

GENERAL

Definitions

1. Type of Screens (Frames and Screening): Light, Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
2. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

System Description

3. Performance Requirements: Comply with following:
   a. Screens: Comply with ANSI/SMA 6001 performance requirements for Type specified or scheduled.
      1) Sag Test Described in ANSI/SMA 6001 Paragraph 4.2.4.2: Applicable to vertical or side hinged operable window screens only.
   b. Operable Screens: Tested with emergency egress locking system:
      1) Screens: Meet or exceed ANSI/SMA 6001 performance requirements for Type specified or scheduled.
   c. Security Screen Insert for Storm Doors: Completely assembled screen of 914 mm (36 inches) by 1 524 mm (60 inches) size with necessary braces:
      1) Impact Test: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.1 performance requirements for Heavy Type.
   d. Security Screen Doors: Completely assembled screen door measuring at least 914 mm (36 inches) wide by 2 032 mm (80 inches) high with necessary braces and hardware:
      1) Impact Test: Meet or exceed performance requirements of ANSI/SMA 6001 Paragraph 4.2.4.1 for Heavy Type.
      2) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.

Submittals

4. Product Data
5. Shop Drawings: Include standard details showing recommendations for installation. Include size of fasteners, maximum dimensions from each end, center-to-center spacing on all four sides, minimum penetration of fasteners into loading material, and maximum clearance between frame and rough opening.
6. Samples: Submit full set of samples of finish colors for color selection.
   a. For Supply and Deliver Only Contract: Submit one full size sample of each type of security window screen and screen door with specified finish for acceptance.
7. Quality Assurance/Control Submittals:
   a. Certificates: Manufacturers written certification that security window screens and door screens meet or exceed ANSI/SMA 6001 and other specified requirements.
   b. Manufacturer's installation instructions.
8. Closeout Submittals:
   a. Operation and maintenance data.
   b. Special warranty.

Quality Assurance

9. Regulatory Requirements:
   a. Egress Requirements: Comply with applicable codes and regulations.
   b. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
   c. Accessibility:
      1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
         a) Uniform Federal Accessibility Standards (UFAS).
      2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
      3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
      4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
10. Certifications: Comply with ANSI Z34.2.
11. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of security window screen and screen door with specified finish for acceptance.
    a. Locations: As directed.
    b. Approved Mock-ups: Standard for rest of work.
    c. Approved Mock-ups: May remain part of completed project.

Delivery, Storage, And Handling

12. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
    a. Screens: Label attached signifying compliance with ANSI/SMA 6001 performance requirements.
13. Acceptance at Site: Inspect screens upon delivery. Replace damaged or defective materials before installation.
14. Storage and Protection: Store screens in manner to protect from weather and other damage.

Project Conditions

15. Field Measurements: Field measure openings for screens before start of fabrication.

Scheduling And Sequencing

16. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

17. Special Warranty: Provide one year written covering materials and installation for security window screens and screen doors.
    a. Warranty: Include coverage of inserts, hardware, and latches.
       1) Screening not included.
       2) Defects resulting from vandalism not included.
    b. For Supply and Delivery Only Contract:
       1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
       2) Contractor: Agrees to supply and deliver free of charge, complete replacement security window screen or screen door, when defective part or parts cannot be installed without use of special tools.
    c. For Supply and Install Contract:
       1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement screen.

PRODUCTS

Security Window Screens And Screen Doors

18. General: Manufactured of commercially accepted materials, free from blemishes, dents, and scratches or any other defects, which are visible when viewed at distance of 1 800 mm (6 ft), or which might otherwise affect their serviceability or appearance.
    a. Screens: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors, and equipment.
    b. Screens: Label attached signifying compliance with ANSI/SMA 6001 requirements.
19. Framing and Cross Brace Members: Made of material which will provide sufficient strength to meet performance requirements of ANSI/SMA 6001, Types as specified or scheduled.
    a. Thickness: Thickness necessary to provide durability and meet performance requirements.
    b. Material: Steel or aluminum as specified or scheduled complying with applicable Federal Specification or ASTM tests and specifications for chemical, physical or mechanical properties.
    c. Light Type: Mechanical comers acceptable.
    d. Medium and Heavy Type: Provide continuously face welded corner joints.
20. Screening: ANSI/SMA 6001 Section 4.3.1, type 304 stainless steel (carbon steel not allowed), Types as specified and scheduled.
    a. Light Type: Minimum 16 by 16 mesh, 0.46 mm (0.018 inch) diameter.
    b. Medium Type: Minimum 12 by 12 mesh, 0.58 mm (0.023 inch) diameter.
    c. Heavy Type: Minimum 12 by 12 mesh, 0.71 mm (0.028 inch) diameter with tensile (high tensile) strength of 1.43 kg per lineal mm width (800 pounds per linear inch width).
    d. Certification: Provide certificate of compliance with specified requirements.
    e. Assembly: Assembled in secure manner to perform as specified to assure neat construction.
        1) Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
    f. Window Screens: Include warning label indicating that screen will not stop child from falling out of window in accordance with SMA 7001.
21. Operable Screens: Frame, or frame and subframe assembly, as required, scribe angles (where required), hinged main frame as required, screening, egress locking system from interior, and concealed hinges.
    a. Screening: Type as specified or scheduled.
    b. Main and Subframes: Steel or extruded aluminum as specified or scheduled and shall conceal locking mechanism from exterior, Type as specified or scheduled.
        1) Aluminum: ANSI/SMA 1004, extruded aluminum.
    c. Operable Screens: May be mounted with vertically or horizontally positioned hinge as indicated.
    d. Operating Hardware: Releasable from interior but properly guarded to prevent access from exterior when window is open.
22. Fixed Screens:
    a. Fixed Frame: Steel or extruded aluminum as specified or scheduled.
    b. Screening: Type as specified or scheduled.
23. Storm Door Screen Inserts: Main frame for application to existing storm door.
    a. Frames: Steel or extruded aluminum as specified or scheduled.
    b. Screening: ANSI/SMA 6001 Heavy Type.
24. Security Screen Doors: Fully assembled pre-hung doors with Z-bar frame, sill expanders with necessary hardware.
    a. Doors Frames: Steel or extruded aluminum as specified or scheduled, ANSI/SMA 6001 Heavy Type.
    b. Screening: ANSI/SMA 6001 Heavy Type.

Aluminum Security Screen Doors

25. Aluminum Screen Doors: Type(s) and size(s) indicated, specified, or scheduled manufactured and provided with prehung aluminum frame line (Z-bar) to fit entrance door apertures requiring frame sizes of 762 mm (30 inches) to 940 mm (37 inches) in width and 2 007 mm (79 inches) to 2 134 mm (84 inches) in height.
    a. Doors: Sized to fit existing openings.

26. Materials:
    a. Master Frame and Mullions: ANSI/SMA 3001, extruded aluminum and minimum 151 kPa (22,000 PSI) tensile strength.
    b. Kick Plate: Embossed or Corrugated Aluminum: Minimum 1.27 mm (0.50 inch) embossed or corrugated thickness, fabricated of minimum 1.02 mm (0.040 inch) thick material.
    c. Screening: Secure by use of aluminum spline integrally mounted and secured with fasteners.
27. Bottom of Door: Provide bottom expander door sweep of non-hardening rubber or extruded vinyl plastic, adjustable to 15.8 mm (5/8 inch).
    a. Bottom Expander: Minimum 1.4 mm (0.055 inch) wall thickness.
28. Door Master Frame Construction: Mitered joint construction and joined at corners by welding or mechanical joints.
    a. Frame Members: Minimum 60 mm (2-3/8 inch) width across flat surface and minimum 31 mm (1-1/4 inch) thickness.
    b. Wall Thickness: Minimum 1.57 mm (0.062 inch).
    c. Mitered Comer Joint Construction: inert gas tungsten arc or heliarc welding to provide screen doors to comply with performance requirements.
        1) Weld: Penetrate on both exterior and interior sides of joint.
        2) Dress weld beads and flat surfaces (edge surfaces not included) to smooth flush surface within satin finish.
        3) Minimum Width of Weld: 9.5 mm (3/8 inch) prior to dressing.
        4) Minimum Penetration of Weld Build-up: Minimum of 2.4 mm (3/32 inch).
    d. Mechanical Comer Joints: Screw boss or gusset construction using screw fasteners standard to manufacturer to provide screen doors to comply with performance requirements.
    e. Master Frame Dimensions: Manufacturing tolerance of plus/minus 4.8 mm (1/8 inch).
    f. Extrusion Tolerances: In accordance with Aluminum Extruded Products Division of Aluminum Association standards.
29. Mullion Bars: Hollow extruded shape designed to permit being used as kick panel mullion or as upper mullion.
    a. Mullion Bars: Minimum 50 mm (2 inch) width across flat surface and minimum 31 mm (1-1/4 inch) thickness.
    b. Wall Thickness: Minimum 1.57 mm (0.062 inch).
    c. Mullions: Accurately machined to fit frame and joined to side stiles by inert gas tungsten arc or heliarc welding or by mechanical clip designed for compatibility.
    d. Dress weld beads down to make smooth flush surface.
    e. Provide main frame and mullion bar with 4.8 mm (3/16 inch) deep grooves to accommodate kick plate.
    f. Utilize weather resisting cement utilized to provide maximum strength and rigidity.
30. Head and Side Z-bars: Designed to receive weatherstripping.
    a. Z-bars: Prepunched installation holes and hinges attached with machine screws.
    b. Head Section: Formed to function as drip cap.
    c. Frame Liner: Z-bar of extruded aluminum, minimum 1.57 mm (0.062 inch) wall thickness.
    d. Weatherstripping: Wool pile or vinyl.
31. Each Door: Three hinges attached to pre-punched Z-bar.
    a. Hinges: Full or 1/2 surface hinges, with three bronze oilite bushings per hinge.

Steel Security Screen Doors

32. Steel Screen Doors: Type(s) and size(s) indicated, specified, or scheduled manufactured of steel and provided with pre-hung aluminum frame liner (Z-bar) to fit entrance door apertures requiring frame sizes of 762 mm (30 inches) to 940 mm (37 inches) in width and 2 007 mm (79 inches) to 2 134 mm (84 inches) in height.
33. Materials:
    a. Master Frame: Not be less than 22 gage (0.85 mm) roll formed steel, or 16 gage (1.6 mm) tubular steel as applicable to hem specified.

b. Kick Plate: At least 18 gage (1.3 mm) embossed galvanized panel for roll formed frame or 16 gage (1.6 mm) flat galvanized steel sheet for tubular steel frame.
c. Screen Insert:
   1) Screening: Secured with fasteners.
   2) Screen Frame: Roll formed or tubular lock seam type formed from not less than 25 gage (0.53 mm) hot dipped galvanized steel or extruded aluminum.
d. Door Sweep Spline: Polyvinyl chloride (PVC) or equal material
e. Frame Liner (Z-bar): Extruded aluminum, 6063 J5.
f. Weatherstripping: Wool pile, or vinyl.

34. Construction:
   a. Master Frame: Roll Formed tubular lock-seam construction formed from 22 gage (0.85 mm) hot dipped galvanized steel.
      1) Comers: Either mitered or butt-jointed and rigidly fastened together by brazing or welding. Insert steel gussets at comers of mitered or butt-jointed screen doors when edge brazing is used.
      2) Welded tubular galvanized steel of 16 gage (1.6 mm) wall thickness is not required to use comer blocks or gussets.
   b. Transom Rail (mullion): Accurately machined or fit frame and rigidly welded to side of stiles.
      1) Kick Plate: Rigidly retained in place by steel or aluminum spline, or form fitted.
   c. Adjustable Expander Installed at bottom of each screen door to receive vinyl sweep.
      1) Adjustment Limit: At least 7.9 mm (5/16 inch).
      2) Vinyl Door Sweep: Installed in entire length of expander.
   d. Frame Liner (Z-bar): Track to receive weather stripping and necessary installation holes.
      1) Head Section of Frame Liner Formed to function as drip cap.
35. Dimensions:
   a. Widths across Master Frames:
      1) For Roll Form Door: Minimum 70 mm (2-3/4 inches).
      2) For Tubular Doors: Minimum 51 mm (2 inches) with 23.7 mm (15/16 inch) minimum thickness.
   b. Mullion Bar: Following minimum widths across:
      1) Roll Form Door: 48 mm (1-7/8 inches).
      2) Tubular Door: 23.7 mm (15/16 inch). Frame Liner: Not less than 27 mm (1-1/16 inch) return offset on outside face for side flange width for bearing against door buck. Wall Thickness of Frame Liner: Minimum 1.57 mm (0.062 inch). Screen Door: Supported adequate reinforcing ribs.
   c. Master Frame Dimensions: Manufacturing tolerance of plus or minus 4.8 mm (1/8 inch).
36. Hinges: Install one of following hinge types on each frame liner and screen door:
   a. At least four concealed 304 stainless steel hinges on bronze oilite bearings, each minimum 75 mm (3 inches) long.
   b. At least three surface-mounted (H) type galvanized steel hinges.

Accessories

37. Hardware: Designed to afford ease of operation, perform functions for which it is intended, and securely attached to screen.
   a. Materials: Stainless steel, aluminum, or made corrosion resistant by plating.
      1) Material: Compatible with frame material.
      2) Stainless Steel: Alloys of 302, and 304.
      3) Aluminum: Extrusions from commercially produced 6063-T5 alloy.
      4) Cadmium or Zinc Plated Steel: ASTM B 633 or ASTM B 766.
      5) Plastic parts not allowed.
   b. Fasteners: Stainless, cadmium plated, or zinc-plated steel screws, nuts, washers, bolts, and' other miscellaneous fastening devices and hardware.
   c. Hinges: Concealed from exterior, with compression guards, and of sufficient strength to comply with performance requirements of ANSI/SMA 6001.

d. Locking System: Non-corrosive materials permitting emergency egress and of sufficient strength to comply with performance requirements of ANSI/SMA 6001.
   1) Provide single point release as and where required by applicable codes and regulations.
   2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.
   3) Locking Hardware: Remain completely concealed from exterior viewing and tampering with lock bolts positively locked when in thrown position, so that they cannot be operated from direct pressure on bolts.

38. Security Screen Door Hardware: Include latch with exterior handle, interior locking mechanism with anti-lockout feature, adjustable heavy duty door closer, necessary screws, and hurricane chain with spring.
39. Window Screens: Include warning label that screen will not stop child from failing out of window in accordance with SMA 7001.
40. Anchors: Non-magnetic stainless steel or other non-corrosive material compatible with screen.
    a. Anchors Exposed when Screen is Closed and Locked: Non-removable security type.

Finishes

41. Screens: Factory applied baked on enamel or polyester powder coat finish.
    a. Exposed Surfaces: Clean and free from serious surface blemishes.
    b. Dress and finish exposed welded joints.
    c. Color: As selected from manufacturers standard colors.

Source Quality Control

42. Testing: Performed by accredited independent testing laboratory.

EXECUTION

Examination

43. Site Verification of Conditions:
    a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
    b. Existing Conditions: Examine openings before beginning installation.
    c. Verify that surfaces to receive security screens are clean.
    d. Do not proceed with installation until conditions are satisfactory.

Preparation

44. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
    a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
    b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
45. Existing Window Screens and Screen Doors: Remove existing window screens and screen doors and debris from site in accordance with Detailed Scope of Work.
46. Preparation: Prepare openings and existing frames in accordance with ASTM E 737 for storm doors and storm windows.
    a. Existing Window and Door Jambs: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new window screens and screen doors.
    b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

47. General: Install in accordance with ASTM E 737 for storm doors and storm windows, manufacturers recommendations, Reference Standards, and approved Shop Drawings.

a. Window Screens and Screen Doors: Securely anchor in place to straight, plumb and level condition, without distortion.
b. Comply with applicable codes and regulations regarding egress requirements and fireman entry.

48. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
    a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.
    b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Adjusting And Cleaning

49. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave window screens, screen doors, and hardware in proper operating condition.
50. Cleaning: Comply with requirements of Detailed Scope of Work.
    a. Clean window screens and screen doors after installation is completed to remove foreign matter and surface blemishes.
    b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

51. Installed Work: Protect window screens and screen doors from damage after installation.

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SECTION 08 11 63 23 - ALUMINUM STORM DOORS

DESCRIPTION OF WORK

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

GENERAL

Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner

System Description

2. Performance Requirements: Comply with following:
   a. Aluminum Storm Doors: ANSI/AAMA 1102.7, Performance Class 25 - 1.2 kPa (25 PSF) Design Pressure, 1.8 kPa (37.5 PSF) Test Pressure.
   b. Stainless Steel Screen Insert: Completely assembled screen of 914 mm (36 inches) by 1 524 mm (60 inches) size with necessary braces:
      1) Impact Test: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.1 performance requirements for Medium Type.
   c. Aluminum Screen Doors: Completely assembled screen door measuring at least 914 mm (36 inches) wide by 2 032 mm (80 inches) high with necessary braces and hardware:
      1) Impact Test: Meet or exceed performance requirements of ANSI/SMA 6001 Paragraph 4.2.4.1 for Medium Type.
      2) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.

Submittals

3. Product Data.
4. Shop Drawings:
   a. Include exploded view of manufactured door, similar to AAMA 1102.7, page 12.
   b. Indicate fabrication of all parts, metal thickness, installation details, fastening, and sealing.
   c. Include sections of typical members and details of latching devices.
5. Samples: Submit full set of finish color samples for color selection.
   a. For Supply and Deliver Only Contract: Submit one full size sample of each type of storm door with specified finish for acceptance.
6. Quality Assurance/Control Submittals:
   a. Certificates: Manufacturers written third party certification that storm doors meet or exceed ANSI/AAMA 1102.7, HUD 39a, and other specified requirements.
   b. Manufacturers installation instructions.
7. Closeout Submittals:
   a. Operation and maintenance data.
   b. Special warranty.

Quality Assurance

8. Regulatory Requirements: Comply with following:
   a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
   b. Accessibility:
      1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).

a) Uniform Federal Accessibility Standards (UFAS).
2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).

9. Certifications: Comply with HUD 39a, ANSI Z34.1, and HUD 24 CFR 200.935.
10. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of storm door with specified finish for acceptance.
    a. Location: As directed.
    b. Approved Mock-up: Standard for rest of work.
    c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

11. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
    a. Storm Doors: Label in accordance with HUD UM 39a signifying compliance with ANSI/AAMA 1102.7 performance requirements.
12. Acceptance at Site: Inspect storm doors upon delivery. Replace damaged or defective materials before installation.
13. Storage and Protection: Store storm doors in manner to protect from weather and other damage.

Project Conditions

14. Field Measurements: Field measure openings for storm doors before start of fabrication.

Scheduling And Sequencing

15. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

16. Special Warranty: Provide one year written covering materials and installation for storm doors.
    a. Warranty: Include coverage of inserts, closers, chains, hardware, and latches.
        1) Screening and glazing not included.
        2) Defects resulting from vandalism riot included.
    b. For Supply and Delivery Only Contract:
        1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
        2) Contractor: Agrees to supply and deliver free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
    c. For Supply and Install Contract:
        1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement storm door.

PRODUCTS

Aluminum Storm And Screen Doors

17. Storm Doors: Type(s) and size(s) indicated, specified, or scheduled with mechanical or welded comer construction complete with tempered glass or plastic glazing inserts where storm glazing is specified or scheduled, screen inserts where specified or scheduled, durable metal kick panel, push plate, adjustable bottom expander with sill sweep, necessary hardware, fasteners, and miscellaneous equipment.
    a. Screen Doors: Meet or exceed Performance Requirements in this Section.
    b. Storm Doors: Meet or exceed applicable requirements of AAMA/ANSI 1102.7, Performance Class 60 and HUD UM 39a.
    c. Storm Doors: Self-storing or seasonal replacement as specified or scheduled.

d. Door Construction: Not necessary to remove door from its installed position to reglaze, rescreen, or replace kick plate, push plate, or protective grille.
e. Glazed Sash and Glazing Materials: Permit reglazing without special tools.
f. Doors: Sized to fit existing openings.

18. Finished Master Frame, Extruded Screen Insert Frame and Z-bar: Minimum 1.4 mm (0.055 inch) wall thickness.
    a. Z-bar: Adequate reinforcing ribs to support door.
19. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
    a. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.
    b. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
        1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
        2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
        3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
        4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
    c. Glass Thickness: In accordance with AAMA 1002.10 Appendix, minimum 5 mm (3/16 inch).
        1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
    d. Glass: Labeled to show name of manufacturer and type.
    e. Glazing Material: Installed in rigid removable aluminum sub-frame.
20. Screens: Manufacturer's standard design.
    a. Screens Not Part of Door Frame: Extruded aluminum frames, of suitable alloy, and of sufficient rigidity, crossbraced as required, to lie flat against door and to prevent excessive bow in frame members and sag in screening.
        1) Screen Spline: Firmly jointed in secure manner.
    b. Screening: Aluminum Wire Fabric: One of following as specified or scheduled:
        1) Regular Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) wire.
        2) Heavy Aluminum: FS RR-W-365, Type VII, 18 x 14 regular, 0.33 mm (0.013 inch) wire.
    c. When screen is completely assembled with insect screening and spline in place, outside dimension as measured from midpoint of opposite framing members shall not vary more than 4.8 mm (3/16 inch) from outside dimension as measured at extreme ends of such framing members.
    d. Screening: Fastened to frame in manner to permit replacement of screening.
21. Stainless Steel Screen: As specified or scheduled:
    a. Screen Frames: Rolled, tubular lock seam construction formed from not less than 25 gage (0.53 mm) hot-dipped galvanized steel or 0.66 mm (0.026 inch) minimum aluminum extruded 6063-T5 alloy (with galvanic protection).
    b. Screening: Stainless Steel: ANSI/SMA 6001 Medium Type, 12 x 12 mesh stainless steel with wire diameter of 0.58 mm (0.023 inch).
    c. Provide screen with fastening devices for application to specific windows for which they are intended and of sufficient strength to perform satisfactorily.
22. Bottom of Door: Provide bottom expander door sweep of non-hardening rubber or extruded vinyl plastic, adjustable to 15.8 mm (5/8 inch).
    a. Bottom Expander: Minimum 1.4 mm (0.055 inch) wall thickness.
23. Kick Plate: Embossed or Corrugated Aluminum: Minimum 1.27 mm (0.50 inch) embossed or corrugated thickness, fabricated of minimum 1.02 mm (0.040 inch) thick material.
24. Hardware: Aluminum, stainless steel, or other non-corrosive materials compatible with aluminum.
    a. Cadmium or Zinc Plated Steel: ASTM B 633 or ASTM B 766.
    b. Include latch with exterior handle and interior locking mechanism with anti-lockout feature, adjustable heavy duty door closer, necessary screws, hurricane chain with spring.
    c. Each Door: 3 hinges attached to Z-bar.

d. Hinges: Full or 1/2 surface hinges, with 3 bronze bushings per hinge.

25. Optional Accessories:
    a. Optional Protective Grille: Perforated aluminum sheet, 0.61 mm (0.24 inches) minimum thickness, riveted or screwed to door frame to completely cover exterior of screen.
    b. Optional Pushplate: Embossed aluminum strip 150 mm (6 inches) high, 1.02 mm (0.040 inch) minimum thickness.
        1) Overall Height of Mullions and Pushplate: Minimum of 200 mm (8 inches) and installed opposite and centered with latch.

Hollow Core Aluminum Storm Doors

26. Door: Hollow extruded smooth surface master frame, 2 hollow extruded smooth surface mullion or cross bars; 2 extruded screen frame inserts, extruded side and head Z-bars, and extruded external telescoping bottom expander.
    a. Extrusions: Manufactured from 6063-T5 extruded aluminum alloy, minimum 1.57 mm (0.062 inch) thick, minimum 151 600 kPa (22,000 PSI) tensile strength.
    b. Glazing Strip, Bottom Sweep, Screening Spline and Z-bar Seal: Virgin polyvinyl plastic.
27. Door Master Frame Comer Construction: Mitered joint construction and joined at comers by welding or mechanical joints.
    a. Mitered Comer Joint Construction: Inert gas tungsten arc or heliarc welding to provide storm doors to comply with performance requirements.
        1) Weld: Penetrate on both exterior and interior sides of joint.
        2) Dress weld beads and flat surfaces (edge surfaces not included) to smooth flush surface within satin finish.
        3) Minimum Width of Weld: 9.5 mm (3/8 inch) prior to dressing.
        4) Minimum Penetration of Weld Build-up: Minimum of 2.4 mm (3/32 inch).
    b. Mechanical Comer Joints: Screw boss or gusset construction using screw fasteners standard to manufacturer to provide storm doors to comply with Performance Requirements in this Section.
28. Mullion Bars: Hollow extruded shape designed to permit being used as kick panel mullion or as upper mullion.
    a. Mullions: Accurately machined to fit frame and joined to side stiles by inert gas tungsten arc or heliarc welding.
    b. Dress weld beads down to make smooth flush surface.
    c. Provide top surface of extrusions for both center and bottom mullion bars with channel to accommodate inserts.
    d. Provide main frame and mullion bar with 4.8 mm (3/16 inch) deep grooves to accommodate kick plate.
    e. Utilize weather resisting cement utilized to provide maximum strength and rigidity and rattle proof operation.
    f. Bottom Mullion Bar: Receive top of kick plate.
    g. Mullion Bar: Same thickness as frame and have minimum 50 mm (2 inch) face.
29. Head and Side Z-bars: Designed to receive vinyl plastic closure strip for maximum seal against air and dust infiltration.
    a. Head Z-bar: Designed and extruded to also function as drip cap over top of door.
    b. Z-bars: Prepunched installation holes and hinges attached with machine screws.
30. Finished Master Frame: Minimum 60 mm (2-3/8 inch) width across flat surface and minimum 25 mm (1 inch) thickness.
    a. Mullion Bars: Minimum 50 mm (2 inch) width across flat surface and minimum 25 mm (1 inch) thickness.
    b. Wall Thickness: Minimum 1.4 mm (0.055 inch).
    c. Extruded Screen Insert Frames: 19 mm (3/4 inch) wide, minimum 7.9 mm (5/16 inch) thick, and minimum 1.57 mm (0.062 inch) wall thickness.
    d. Z-bars: Minimum 1.4 mm (0.055 inch) wall thickness plus adequate reinforcing ribs to support door.

e. Insert Frame: Fabricated to have minimum overall clearance of 4.8 mm (1/8 inch) in width and height, and interchangeable in doors of same nominal size.
f. Master Frame Dimensions: Manufacturing tolerance of plus/minus 4.8 mm (1/8 inch).
g. Extrusion Tolerances: In accordance with Aluminum Extruded Products Division of Aluminum Association standards.

31. Glazing Insert Frames: Extruded with mitered joint construction secured at comers by staking into comer gussets.
    a. Inserts: Equal height making them interchangeable on doors with upper and lower openings.
    b. Inserts: Held in door by aluminum clips and machine screws.
    c. Install maximum of 6 rivnuts into door per insert.
    d. Install rivnuts in master frame, 2 on each side and top of each insert, located not to interfere with installation of door closer or safety chain.
    e. Insert: Positive contact with master frame to stop passage of insects and prevent rattling.
32. Screening Insert Frames: Extruded tubular with mitered joint construction and secured at comers by staking into comer gussets.
    a. Make square comer gussets of 0.46 mm (0.180 inch) minimum extruded aluminum to fit firmly against extruded insert frames to minimize twist and distortion.
    b. Insert screening into groove provided in frame and secure by vinyl spline.
    c. Inserts in Doors with Upper and Lower Openings: Equal height making them interchangeable, and secured into master frame by same method as specified for glazed inserts.
33. Hinges: 3 knuckle construction, not less than 98 mm (3-7/8 inches) in length, with minimum of 3 prepunched screw holes in hinge leaf of minimum thickness 0.31 mm (0.120 inch) plus adequate longitudinal reinforcing ribs to support door.
    a. Each Door: Supported with not less than 4 built-in type hinges employing raised knuckle on extruded Z-bar to receive half-extruded aluminum hinge leaf joined at knuckle by using 2 stainless steel or cadmium plated steel pins pivoting through oilite or nylon bushings.
    b. Pins: Held securely in place by cadmium plated steel compression springs.
    c. Hinge: Allow door to open 180 degrees.

Solid Core (Laminated) Storm Door

34. Materials:
    a. Main Frame and Glass Edge Surround Members (if not part of main frame): Aluminum of sufficient strength to comply with performance requirements of ANSI/AAMA 1102.7.
    b. Reinforcing Members: Aluminum or other non-corrosive materials compatible with aluminum.
        1) Carbon Steel: Cadmium or zinc-plated in accordance with ASTM B 633 or ASTM B 766.
35. Finished Master Frame: Extruded screen insert frame and Z-bar minimum 1.4 mm (0.055 inch) wall thickness.
    a. Z-bar: Adequate reinforcing ribs to support door.
36. Door: Laminated construction consisting of minimum 19.1 mm (3/4 inch) thick particle board, grade 1-M-3 with seamless aluminum skins bonded together.
    a. Particle Board Core Material: Completely sealed with polyurethane for moisture protection.
    b. Ureaformaldehyde binders not allowed.
37. Screws, Nuts, Washers, Bolts, Rivets and Other Fastening Devices: Aluminum, stainless steel or other non-corrosive materials compatible with aluminum.
    a. Cadmium or Zinc-plated Steel: ASTM B 633 or ASTM B 766.
38. Weatherstrip: Weatherstrip Z-bars with woven pile so that there is no metal to metal contact between main frame and Z-bar.
    a. Install weatherstripping in specially extruded ports and in accordance with AAMA 701.2.
39. Anti-galling Devices: Non-corrosive materials compatible with aluminum and of sufficient strength to perform as designed.

Accessories

40. Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.

Finishes

41. Finish:
    a. Aluminum Finish: Provide one of following as specified or scheduled:
        1) Factory applied pigmented organic coating, AAMA 603.8.
            a) Color: As selected from manufacturer's standard colors.
        2) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
    b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
    c. Dress and finish exposed welded joints.

Source Quality Control

42. Testing: Performed under Third Party Administrator in compliance with HUD 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION

Examination

43. Site Verification of Conditions:
    a. Field Measurements: Verity field measurements are as indicated on Shop Drawings.
    b. Existing Conditions: Examine openings before beginning installation.
    c. Verity that surfaces to receive storm doors are clean.
    d. Do not proceed with installation until conditions are satisfactory.

Preparation

44. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
    a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
    b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
45. Existing Storm Doors: Remove existing screen and storm doors and debris from site in accordance with Detailed Scope of Work.
46. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.
    a. Prime Door Jambs of Existing Prime Doors: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new storm doors.
    b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

47. General: Install in accordance with ASTM E 737, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
    a. Securely fasten storm doors in place to straight, plumb and level condition, without distortion of door or door frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
    b. In high wind areas, install storm door hinges on side to prevailing wind as directed.
48. Joint Sealants: Apply in accordance with manufacturer's recommendations.
    a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
    b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
    c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
    d. Seal joints between perimeter of storm door frame and underlying or surrounding construction with joint sealant to accomplish weather-tight installation.

e. Maximum Width of Sealed Joint: 13 mm (1/2 inch).

49. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
    a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.
    b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Adjusting And Cleaning

50. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave storm doors and hardware in proper operating condition.
51. Cleaning: Comply with requirements of Detailed Scope of Work.
    a. Clean storm doors after installation is completed to remove foreign matter and surface blemishes.
    b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

52. Installed Work: Protect storm doors from damage after installation.

END OF SECTION 08 11 63 23

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SECTION 08 11 73 00 - SLIDING METAL FIRE DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for sliding metal fire doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Single-leaf, power-operated and manually operated sliding door with or without pass door.
b. Biparting, power-operated and manually operated sliding door with or without pass door.
c. Multiple-leaf, power-operated and manually operated sliding door with or without pass door.

C. Performance Requirements
1. Structural Performance: Provide horizontal sliding doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
a. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), **unless required otherwise by the location of the work**, acting inward or outward.

D. Submittals
1. Product Data: For each type of product indicated.
a. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Product Certificates: For sliding metal fire doors, signed by product manufacturer.
4. Oversize Construction Certification: For door assemblies required to be fire rated and that exceed size limitations of labeled assemblies, signed by authorized representative of testing agency.
5. Operation and Maintenance Data: For sliding metal fire doors to include in emergency, operation, and maintenance manuals.

E. Quality Assurance
1. Fire-Rated Sliding Door Assemblies: Provide assemblies complying with NFPA 80 that are identical to door assemblies tested for fire-test-response characteristics according to NFPA 252 or UL 10B, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing agency acceptable to authorities having jurisdiction.
a. Test Pressure: Test at as close to neutral pressure as possible.
b. Oversize Fire-Rated Sliding Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with all standard construction requirements of tested and labeled fire-rated door assemblies except for size.
c. Provide units with labels showing 250 deg F (139 deg C) **OR** 450 deg F (250 deg C) **OR** 650 deg F (361 deg C), **as directed**, temperature-rise ratings.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Materials
1. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M, Commercial Steel (CS), or Drawing Steel (DS), Type B, exposed, matte finish.
2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 (ZF180) **OR** A90 (ZF275), **as directed**, zinc-iron-alloy (galvannealed) coating or G90 (Z275) **OR** G60 (Z180), **as directed**, zinc coating; restricted flatness.
3. Stainless-Steel Sheets: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**; stretcher-leveled standard of flatness; No. 4 satin **OR** 6 dull, **as directed**, finish.
4. Hardware and Fasteners: Manufacturer's standard units **OR** Hot-dip galvanize per ASTM A 153/A 153M where items are used on galvanized steel exterior doors **OR** Stainless steel **OR** Stainless steel where indicated, **as directed**.

B. Sliding Metal Fire Doors
1. Overhead-Supported Doors: Provide composite **OR** hollow-metal **OR** tubular-frame, **as directed**,-type construction fire door assemblies with wall-mounted overhead track support and the following fire-protection rating and panel facing sheet material and thickness:
2. Bottom-Support Doors: Provide bottom-support, tubular-frame-type construction fire door assemblies with floor track, top guides, and the following fire-protection rating, temperature-rise rating, and face sheet material and thickness:
    a. Fire-Protection Rating: 4 hours **OR** 3 hours **OR** 1-1/2 hours **OR** 3/4 hour **OR** As indicated, **as directed**.
    b. Panel Facing:
        1) Steel: 0.033-inch (0.8-mm) **OR** 0.043-inch (1.1-mm) **OR** 0.053-inch (1.35-mm) **OR** 0.067-inch (1.7-mm), **as directed**, minimum thickness.
        2) Metallic-Coated Steel: 0.040-inch (1.0-mm) **OR** 0.052-inch (1.3-mm) **OR** 0.064-inch (1.6-mm) **OR** 0.079-inch (2.0-mm), **as directed**, nominal thickness.
        3) Stainless Steel: 0.038-inch (0.96-mm) **OR** 0.050-inch (1.3-mm) **OR** 0.062-inch (1.57-mm) **OR** 0.078-inch (1.98-mm), **as directed**, nominal thickness.
3. Operating Hardware: Manufacturer's standard, labeled, automatic-closing-type, sliding fire door assemblies complete with track, adjustable roller guides, binders, floor stops, cables, sheaves, counterweights, and fusible links. Furnish necessary hangers, fittings, and fasteners required for attaching hardware to door and for door sliding operation, including latch or handle for manual operation. Provide hot-dip galvanized steel **OR** electrogalvanized steel **OR** factory-prime-painted steel **OR** stainless-steel, **as directed**, hardware.
4. Weight Boxes: 0.064-inch- (1.6-mm-) thick, metallic-coated steel counterweight boxes or guards; size as required for counterweights and clearance.
5. Crush Plates: 3/16-inch-thick by 6-inch-wide (4.8-mm-thick by 150-mm-wide), continuous steel plates on hollow concrete masonry walls.
6. Track Hood: Formed, metallic-coated steel sheet **OR** stainless-steel, **as directed**; size as required for clearance and to protect tracks on exterior installations.
7. Weather Stripping: UL-classified, brush-style weather stripping with attachments for mounting at head, jambs, and bottom surface of door.
8. Motorized Operator: UL-approved, high-starting torque, reversing motor and adjustable speed operator with thermal-overload protection. Include fusible-link release to disengage operator and to allow door to close automatically.
    a. Design operator for current characteristics of electrical service supplied. Provide UL-listed, 1/2-hp, 208- to 230-V ac, single-phase **OR** 208-V ac, 3-phase **OR** 220-V ac, 3-phase **OR** 480-V ac, 3-phase, **as directed**, 60-cycle motor with NEMA 250, Type 1 enclosure and 24-V ac, secondary control voltage.
    b. Equip door for completely automatic operation with clutch, speed reducer, brake, limit switches, electric reverse edge, brackets, bolts, and release for manual operation. Control equipment includes two pull cords **OR** two 3-button control stations with push buttons labeled "OPEN," "CLOSE," and "STOP" **OR** two motion detectors **OR** two loop detectors

OR two photoelectric obstruction detectors **OR** time delay for closing, **as directed**, and electric interlock for pass door.

9. Interconnecting Device: Device for connecting fusible links for doors on both sides of wall.
10. Door Release Devices: Electromagnetic release devices compatible with smoke detectors or building's fire alarm system.
11. Fire Detection: Provide early warning, photoelectric smoke detectors or ionization detectors to be coupled to electromagnetic door release devices.
12. Pass Door: UL-listed swing door and frame.
13. Pass Door Hardware: Factory installed with one and one-half pairs of mortise spring hinges **OR** butt hinges and closer, **as directed**, and mortise latchset **OR** mortise lock **OR** exit device **OR** panic device, **as directed**.
    a. Provide hardware complying with Division 08 Section "Door Hardware".
14. Vision Panels: Factory fabricated in door with integral removable glass stops. Provide UL-approved, wired glass panels or other fire-resistive glazing product acceptable to authorities having jurisdiction; do not exceed area allowed for door rating.

C. Fabrication
1. Composite-Type Doors: Fabricate in modular panels. Bond face materials to both sides of core and reinforce perimeter with minimum 0.043-inch- (1.1-mm-) thick, internal steel channel. Encase panel edges with minimum 0.067-inch- (1.7-mm-) thick, steel channel. Back joints in face sheets with minimum 0.043-inch- (1.1-mm-) thick, steel H column. Connect panels with H column and cover plate. Attach armor edges and astragals to doors.
2. Hollow-Metal Doors: Bond face materials to both sides of core and reinforce perimeter with minimum 0.043-inch- (1.1-mm-) thick, internal steel channel. Back joints in face sheets with minimum 0.043-inch- (1.1-mm-) thick, steel H column. Weld and fill joints and grind exposed welds smooth. Attach armor edges and astragals to doors.
3. Tubular-Frame Doors: Fabricate perimeter frame and internal stiffeners of minimum 0.043-inch- (1.1-mm-) thick steel tubes. Miter corner joints in frame and weld frame and stiffener joints. Locate joints in face sheets over stiffeners. Weld and fill joints and grind exposed welds smooth. Attach armor edges and astragals to doors.
4. Core Construction: Provide core materials complying with fire-protection-rating and temperature-rise requirements.
    a. Resin-impregnated honeycomb.
    b. Mineral-fiber board.
    c. Urethane.
    d. Fiberglass.
    e. Calcium silicate
    f. Inorganic mineral.
    g. Manufacturer's standard.

D. Steel Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Preparation for Shop Priming: After galvanizing, thoroughly clean metal of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate pretreatment.
3. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of sliding metal fire doors:
    a. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
    b. Interiors (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. Prime Finish: Immediately after cleaning and pretreating, apply manufacturer's standard rust-inhibiting primer on **OR** zinc-rich primer on metallic-coated, **as directed**, steel doors for field painting.
5. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with

paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

a. Color and Gloss: As selected from manufacturer's full range.

1.3 EXECUTION

A. Installation

1. Install sliding metal fire doors according to NFPA 80 and manufacturer's written instructions for type of door operation indicated and fire-protection rating required.
   a. Interface fire-detection devices with building's fire alarm system.
2. Drill necessary holes cleanly, with no broken areas or spalls, for installation of fasteners in concrete or masonry. Remove and replace damaged masonry as directed.

B. Adjusting And Cleaning

1. Operate sliding metal fire doors on completion of installation to ensure satisfactory operation. Check moving parts for proper alignment and lubrication. Make adjustments for smooth, easy operation.
   a. Test door closing when activated by detector or alarm-connected, fire-release system. Reset door-closing mechanism after successful test.
2. Clean surfaces and refinish abraded or damaged surfaces to match factory finish.

END OF SECTION 08 11 73 00

SECTION 08 12 13 13 - STEEL ENTRY DOORS

1.1 DESCRIPTION OF WORK

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

1.2 GENERAL

A. Definitions
1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

B. System Description
1. Door Assemblies: Include doors, frames, and hardware
a. Provide with fire rating as indicated or specified.
b. Door and Frame Assemblies: Comply with dimensional requirements of SDI 100.
c. Exterior Doors: Sealed, weatherstripped and provided with thresholds.
2. Insulated Entry Door System (Assembly) Performance Requirements:
a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level C (250,000 cycles).
b. Air Infiltration: ANSI/ISDSI 101 and ASTM E 283, not exceed 0.029 cu m/s/mm (0.20 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
c. Water Resistance: ANSI/ISDSI 104 and ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
d. Thermal Performance: ANSI/ISDSI 107, minimum acceptance criteria as defined in standard except U-Value of 1.42 W/sq. m C (0.25 BTU/HR/SF degree F).
e. Acoustical Performance: ANSI/ISDSI 103, Minimum Sound Transmission Class (STC) of 24.
3. Hollow Core Heavy Duty System (Assembly) Performance Requirements:
a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level B (500,000 cycles).
b. Air Infiltration: SDI 116 and ASTM E 283, not exceed 0.072 cu m/s/mm (0.50 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
c. Water Resistance: ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
4. Insulated Heavy Duty Door System (Assembly) Performance Requirements:
a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level B (500,000 cycles).
b. Air Infiltration: ANSI/ISDSI 101/ASTM E 283, not exceed 0.029 cu m/s/mm (0.20 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
c. Water Resistance: ANSI/ISDSI 104 and ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
d. Thermal Performance: ANSI/ISDSI 107, minimum acceptance criteria as defined in standard except U-Value of 1.42 W/sq. m C (0.25 BTU/HR SF degree F) is required.
e. Acoustical Performance: ANSI/ISDSI 103, Minimum Sound Transmission Class (STC) of 24.
5. Security Door System (Assembly) Performance Requirements:
a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level A (1,000,000 cycles).
b. Air Infiltration: SDI 116 and ASTM E 283, not exceed 0.72 cu m/s/mm (0.50 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
c. Water Resistance: ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
d. Forced Entry: ASTM F 476, Grade 40.

C. Submittals
1. Product Data.
2. Shop Drawings:
   a. Include details showing recommendations for installation of doors. Include size of fasteners, spacing, minimum penetration of fasteners into load-bearing material and maximum clearance between frame and rough opening.
3. Samples: Submit full set of finish color samples for color selection.
   a. For Supply and Deliver Only Contract: Submit one full size sample of each type of steel entry door with specified finish for acceptance.
4. Quality Assurance/Control Submittals:
   a. Test Reports: Results of testing by accredited independent laboratory demonstrating compliance of door systems with specified performance requirements.
      1) Indicate that tests were performed in accordance with standard referenced.
      2) Weak Link Testing. Submit reports for each model door in its weakest condition in order to quality superior variations of same model.
   b. Certificates: Manufacturer's written certification that door systems meet or exceed specified requirements.
   c. Manufacturer's installation instructions.
5. Closeout Submittals:
   a. Operation and maintenance data.
   b. Special warranty.

D. Quality Assurance
1. Regulatory Requirements: Comply with following:
   a. Fire Rated Label: Determined using ASTM E 152 and bear label of UL or other recognized fire rating program.
   b. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
   c. Accessibility:
      1) Architectural Barriers Act of 1968 as amended (42 USC 4151-4157) and HUD implementing regulations (24 CFR Part 40).
         a) Uniform Federal Accessibility Standards (UFAS).
      2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
      3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
      4) Americans with Disabilities Act of 1990 (ADA) (42 USC §§ 12101, et seq.) and implementing regulations (28 CFR Part 35).
2. Certifications:
   a. Door Systems: Meet or exceed performance requirements and other requirements specified and be labeled under HUD accepted Materials Releases.
   b. Some Material Releases (MR) do not include all of performance requirements specified. Therefore, additional testing, certification may be required for submission with HUD Material Releases.
      1) Material Releases are part of HUD Technical Suitability of Building Products Program. Contact: Department of Housing and Urban Development, Manufactured Housing and Construction Standards, 451 7th Street, SW, Washington, D.C. 20410-8000.
3. Mock-ups: Install one mock-up of each type of entry door system including doors, frames, hardware, weatherstripping, thresholds, and accessories.
   a. Location: As directed.
   b. Approved Mock-up: Standard for rest of work.
   c. Approved Mock-up: May remain part of completed project.

E. Delivery, Storage, And Handling
1. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.

2. Acceptance at Site: Inspect door systems upon delivery. Replace damaged or defective materials before installation.

F. Project Conditions
1. Field Measurements: Field measure openings for door systems before start of fabrication.

G. Scheduling And Sequencing
1. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

H. Warranty
1. Special Warranty: Provide one year written warranty covering materials and installation for steel entry doors.
a. Warranty: Include coverage of hardware.
1) Glazing not included.
2) Defects resulting from vandalism not included.
b. For Supply and Delivery Only Contract:
1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
2) Contractor: Agrees to supply and deliver free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
c. For Supply and Install Contract:
1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement door.

1.3 PRODUCTS

A. Doors
1. Doors: Consist of two steel face sheets, wood or steel stiles and rails with full support lock reinforcement.
a. Thickness: Nominal 44.4 mm (1-3/4 inch)
b. Steel Face: Minimum of 24 gage (0.57 mm) galvanized and bonderized steel.
c. Wood Stiles and Rails: Kiln dried clear Ponderosa Pine, Douglas Fir, or equal.
d. Embossed Designs: Emboss 24 gage (0.57 mm) doors and 18 gage (1.07 mm) doors to achieve scheduled or indicated designs.
2. Hollow Core Heavy Duty Doors: Fabricated of 18 gage (1.07 mm) minimum steel face sheets, stiles, top and bottom closures.
a. Comply with Performance Requirements in this Section.
b. Fire Rating: When required, provide B Label, 1-1/2 hour fire rating.
3. Insulated Heavy Duty Doors: Fabricated of 18 gage (1.07 mm) minimum steel face sheets, stiles, top and bottom closures.
a. Comply with Performance Requirements in this Section.
b. Fire Rating: When required, provide B Label, 1-1 /2 hour fire rating.
4. Security Doors: Comply with SDI 100, Models 1, 1A, 2, or 2A, minimum 16 gage (1.35 mm) steel face sheets .
a. Comply with Performance Requirements in this Section.
b. Fire Rating: When required, provide B Label, 1-1/2 hour fire rating.
5. Hardware Preparation:
a. Door System: Facilitate installation of standard cylindrical and/or full mortise locks with multiple point throw if specified.
b. 24 gage (0.57 mm) Doors: Prepare to receive three 102 mm (4 inch) full mortise or bun hinges flush with edge of door.
c. 18 Gage (1.07 mm) and Heavier Doors: Prepare to receive three 114 mm (4-1/2 inch) full mortise or butt hinges flush with edge of door.
6. Insulated Doors: Solid foam core of polyurethane, or polystyrene.
a. Core: Fully adhere to steel face sheets, stiles, rails and lock block and completely fill void.

B. Frames
1. Wood Frames: Kiln dried Ponderosa Pine, toxic treated, and primed.
2. Steel Frames and/or Adapter Frames: Minimum of 18 gage (1.07 mm) galvanized bonderized steel, pre-drilled and reinforced for hinges as required.
   a. Shape of Frame: Generally L-shaped.
3. Hollow Core Heavy Duty Door Frames: Fabricated of 16 gage (1.35 mm) minimum thickness.
   a. When required, provide B Label, 1-1/2 hour fire rating.
4. Insulated Heavy Duty Door Frames: Fabricated of 16 gage (1.35 mm) minimum thickness.
   a. When required, provide B Label, 1-1/2 hour fire rating.
5. Security Door Frames: Comply with SDI 100, minimum of 14 gage (1.70 mm) galvanized bonderized steel, pre-drilled and reinforced for hinges as required.
   a. When required, provide B Label, 1-1/2 hour fire rating.
   b. Comply with Performance Requirements in this Section.
6. Frames: Weatherstripped at head, jambs and threshold.

C. Hardware
1. General: Comply with ANSI/BHMA A156.1 and applicable accessibility regulatory requirements and perform functions for which it was intended.
2. Butts and Hinges: ANSI/BHMA A156.1, as scheduled.
   a. Install non-rising pins (NRP) on out-swing doors.
   b. Self Closing: ANSI/BHMA A156.17.
   c. Security Door Comply with Performance Requirements in this Section.
3. Fire Rate Doors Hardware: Comply with NFPA 80.
   a. Exit Doors: Comply with NFPA 101 (Life Safety Code) for exit doors, as well as other requirements specified.
   b. Labeling and Listing: Listed in UL Building Materials Directory.
      1) In Lieu of UL Labeling and Listing: Test reports from nationally recognized testing agency showing that hardware has been tested in accordance with UL test methods and conforms to NFPA requirements.
   c. Install minimum latch throw as specified on label of individual door.
   d. Provide hardware listed by UL, except where heavier materials, larger sizes or higher grades are specified.
   e. Closers: ANSI/BHMA A156.4.
4. Lock Sets: As scheduled. Comply with following standards:
   a. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2, Grade 2.
   b. Dead Bolt: ANSI/BHMA Al 56.5.
   c. Mortise Locks and Latches: ANSI/BHMA A156.13, Grade 1 or Security Grade, single or multiple throw.
   d. Interconnected Deadlock and Passage Set: ANSI/BHMA A156.12, Grade 2.
   e. Cylindrical Lock: Grade 2, cylindrical deadbolt lock/passage set combination.
   f. Security Door Locksets: ANSI/BHMA A156.13 Security Grade or UL 437 Key locks.
      1) Comply with Performance Requirements in this Section.
   g. Keys: Provide two keys for each lock provided. Provide master keying and keying alike on any locks as directed at no additional charge.
   h. Locks: Provide with interchangeable cores.
5. Door Viewers: ANSI/BHMA A156.16.

D. Accessories
1. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
   a. Glass: ASTM C 1036, Type 1, Class 1, Glazing B Quality.
      1) Fire Rated Doors: ASTM C 1036, Type 11, Class 1, Glazing Quality, wired glass.
   b. Tempered Glass: ASTM C 1048, Kind FT. Condition A, Type 1, Class 1, Glazing B Quality.
   c. Plastic: Extruded polycarbonate clear sheets, minimum 3 mm (0.118 inch) thick with following characteristics:
      1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.

2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.

d. Insulating Glass Units: HUD UM 82 and ASTM E 774, Class C.
1) Provide insulating glass units in insulated doors and insulated heavy duty doors.

e. Glass Thickness: In accordance with AAMA 1002.10 Appendix, minimum 5 mm (3/16 inch).
1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.

f. Glass: Labeled to show name of manufacturer and type.

2. Joint Sealants:
a. Exterior Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.
b. Back-up Material: Standard preformed and pre-compressed foam material, round rod or semi-circular type, permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and with sealant.
1) Materials impregnated with oil, solvents, or bituminous materials not allowed.
2) Provide type as recommended by sealant manufacturer for particular installation.
3) Material: Neoprene, butyl, polyurethane, vinyl, or polyethylene rod.
c. Interior Joint Sealant: ASTM C 834, latex acrylic.

3. Weatherstripping and Thresholds: Comply with FS 00-A-200-9D, Alloy 6063-T-5; ASTM D 2287, Grade as required; MIL-S-6855, Class 11, Grade 40 (Solid neoprene); and MIL-R-6130C, Type 11, Grade C (Sponge neoprene).
a. Weatherstripping for Doors and Frames: Adjustable types with replaceable contact stops. Types are listed below:
1) Type A1 (for bottom of door with threshold greater than 6 mm (1/4 inch)): Solid neoprene or vinyl strips mounted in extruded aluminum retainers.
2) Type B (for bottom of door with thresholds less than 6 mm (1/4 inch) in height): Curved vinyl strips with extruded aluminum retainers.
3) Type C (for door frame heads and jambs): Extruded aluminum retainer with extruded solid vinyl insert.
4) Type D1 (for door frame heads and jambs): Closed cell sponge neoprene or vinyl strip with leveled edge mounted in extruded aluminum retainer.
b. Rain Drips: Extruded aluminum with sufficient projection.
c. Fasteners: Cad plated steel, brass plated steel, black oxide plated steel, or stainless steel.
1) Threshold to Concrete: Provide lead expansion shields.
2) Exposed Finish: Match finish of weatherstrip.

E. Finishes
1. Entry Door System: Clean and free from serious surface blemishes.
a. Exposed Surfaces: ASTM A 525 hot dipped galvanized, minimum A40 (or G60) Electrolytic Class B coating weight.
b. Primer: Factory final finished including primer meeting performance requirements of ANSI A224.1.
c. Finish Coat: One of the following as specified or scheduled:
1) Factory Finished: Electrostatically factory applied baked on enamel finish.
a) Color: As selected from manufacturers' list of colors.
2) Field painted under Division 9 Section "Painting."

F. Source Quality Control
1. Testing: Performed by accredited independent testing laboratory.
2. Shop Tests:
a. Mechanical Properties Tests: ANSI/SDI A151.1, perform on lightest gage frame and leaf.
1) Security Doors: ASTM F 476.
2) Doors with Glass Lites: Mechanical test not required.

b. Air Infiltration and Water Resistance Tests: Perform on door with largest glass lite. Retest variations in frame to leaf sealing system.
   1) Air Infiltration Tests: ANSI/ISDSI 101, SDI 116, and ASTM E 283.
   2) Water Resistance Tests: ANSI/ISDSI 104 and ASTM E 331.
c. Thermal Performance Tests: Perform on heaviest gage frame and leaf with largest area of glass. Retest variation in thermal design aspects of door such as different insulation, type of thermal break, or type of frame.
   1) Thermal Performance Tests: ANSI/ISDSI 107 and SDI 113.
d. Test Sample Size for Door System: Minimum 914 mm (36 inches) by 1 727 mm (68 inches), complete with hardware and subframe.

1.4 EXECUTION

A. Examination
1. Site Verification of Conditions:
   a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
   b. Existing Conditions: Examine openings before beginning installation.
   c. Do not proceed with installation until conditions are satisfactory.

B. Preparation
1. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
   a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
   b. Adequately enclose and protect against weather any interior space where installation is incomplete at end of working day.
   c. Repair or replace damaged elements in accordance with Detailed Scope of Work.
2. Existing Entry Doors: Remove existing entry doors and debris from site in accordance with Detailed Scope of Work.
3. Prepare existing openings in accordance with ANSI/ISDSI 102, SDI 105, ASTM E 737, manufacturer’s recommendations, and approved Shop Drawings.

C. Installation
1. General: Install in accordance with ANSI/ISDSI 102, SDI 105, ASTM E 737, manufacturer's recommendations, and approved Shop Drawings.
   a. Install doors and frames securely, water tight, straight, plumb and level without distortion.
2. Weatherstripping and Thresholds: Accurately cut, fit, align, and secure to maintain weatherproof seal without hampering operation of door.
   a. Rain Drips: Install on door heads which are not protected by canopy or soffit.
   b. Secure thresholds to concrete with stainless screws or equal and lead expansion shields.
   c. Blocking: Provide as necessary to secure hardware. Prime cut wood surfaces with wood sealer before weatherstripping is installed.
3. Joint Sealants: Apply in accordance with manufacturers recommendations.
   a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
   b. Prime cleaned surfaces in accordance with sealant manufacturer’s recommendations.
   c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
   d. Seal door frames and thresholds where joining other materials on exterior and interior with joint sealant to accomplish weather-tight installation.
   e. Maximum Width of Sealed Joint: 13 mm (1/2 inch).

D. Adjusting And Cleaning

1. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave doors and hardware in proper operating condition.
2. Cleaning: Comply with requirements of Detailed Scope of Work.
   a. Clean doors, after installation is completed, to remove foreign matter and surface blemishes.
   b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

E. Protection
   1. Installed Work: Protect doors from damage after installation.

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SECTION 08 12 13 13a - STAINLESS STEEL DOORS AND FRAMES

1.1 GENERAL

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

B. Summary
1. Section Includes:
   a. Stainless-steel, hollow-metal doors and panels.
   b. Stainless-steel, hollow-metal frames.

C. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
2. Shop Drawings: Include the following:
   a. Elevations of each door design.
   b. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   c. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   d. Locations of reinforcement and preparations for hardware.
   e. Details of each different wall opening condition.
   f. Details of anchorages, joints, field splices, and connections.
   g. Details of accessories.
   h. Details of moldings, removable stops, and glazing.
   i. Details of conduit and preparations for power, signal, and control systems.
3. Samples:
   a. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
   b. Doors: Include section of vertical-edge, top, and bottom construction; core construction; glazing; and hinge and other applied hardware reinforcement.
   c. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
4. Schedule: Provide a schedule of stainless-steel, hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with a door hardware schedule.
5. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of stainless-steel, hollow-metal door and frame assembly.

D. Quality Assurance
1. Source Limitations: Obtain stainless-steel, hollow-metal work from single source from single manufacturer.
2. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature

end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

3. Smoke- and Draft-Control Door Assemblies: Where indicated **OR** At corridors, smoke barriers, and smoke partitions, **as directed**, provide assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
4. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies that are listed and labeled, by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite. Install in compliance with NFPA 80.
5. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
2. Shipping Spreaders: Deliver welded frames with two removable spreader bars across bottom of frames, tack welded or mechanically attached to jambs and mullions.
3. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
   a. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

F. Project Conditions
1. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

G. Coordination
1. Coordinate installation of anchorages for stainless-steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.2 PRODUCTS

A. Stainless-Steel Doors
1. Description: Stainless-steel doors, not less than 1-3/4 inches (44 mm) thick, of seamed **OR** seamless, **as directed**, hollow-metal construction. Construct doors with smooth, flush surfaces without visible joints or seams on faces.
   a. Face Sheets: Fabricate from 0.050-inch- (1.27-mm-) **OR** 0.062-inch- (1.59-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet.
   b. Core Construction: Fabricate doors with core indicated.
      1) Welded Steel-Stiffened Core: 0.031-inch- (0.79-mm-) thick, stainless-steel **OR** 0.030-inch- (0.76-mm-) nominal thickness uncoated steel **OR** 0.034-inch- (0.86-mm-) nominal thickness metallic-coated steel, **as directed**, vertical stiffeners extending full-door height, spaced not more than 6 inches (152 mm) apart, spot welded to face sheets a maximum of 5 inches (127 mm) o.c. Fill spaces between stiffeners with mineral-fiber insulation.
      2) Laminated Core: Honeycomb of resin-impregnated kraft paper with maximum 1-inch (25.4-mm) cells or foam-plastic insulation fastened to face sheets with waterproof adhesive.
         a) Foam-Plastic Insulated Doors: Thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) **OR** 6.0 deg F x h x sq.

ft./Btu (1.057 K x sq. m/W) **OR** 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W), **as directed**, when tested according to ASTM C 1363.

i. Locations: Exterior doors and interior doors, where indicated.

3) Laminated Steel-Stiffened Core: 0.031-inch- (0.79-mm-) thick, stainless-steel **OR** 0.030-inch- (0.76-mm-) nominal thickness uncoated steel **OR** 0.034-inch- (0.86-mm-) nominal thickness metallic-coated steel, **as directed**, vertical stiffeners extending full-door height, spaced not more than 6 inches (152 mm) apart, fastened to face sheets with waterproof adhesive. Fill spaces between stiffeners with mineral-fiber insulation.

4) Fire-Rated Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

c. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches (3 mm in 50 mm).

d. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.

e. Moldings for Glazed Lites in Doors: 0.038-inch- (0.95-mm-) thick stainless steel.

f. Loose Stops for Glazed Lites in Doors: 0.038-inch- (0.95-mm-) thick stainless steel.

g. Top and Bottom Channels: Closed with continuous channels, 0.062-inch- (1.59-mm-) thick stainless steel **OR** 0.060-inch- (1.52-mm-) nominal thickness uncoated steel **OR** 0.064-inch- (1.63-mm-) nominal thickness metallic-coated steel, **as directed**.

1) Spot welded to both face sheets.
OR
Securely fastened using adhesive.

h. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 866 with reinforcing plates from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.

i. Electrical Hardware Enclosures: Provide enclosures and junction boxes within doors for electrically operated door hardware, interconnected with UL-approved, 1/2-inch- (12.7-mm-) diameter conduit and connectors.

1) Where indicated for installation of wiring, provide access plates to junction boxes, fabricate from same material and thickness as face sheet and fasten with at least four security fasteners spaced not more than 6 inches (152 mm) o.c.

2. Performance: Level A, ANSI A250.4.

3. Materials:

a. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304 **OR** Type 316 **OR** Type 317LMN **OR** 904L, **as directed**.

b. Steel Sheet: ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.

c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

d. Foam-Plastic Insulation: Manufacturer's standard polystyrene **OR** urethane, **as directed**, board insulation with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within door.

e. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

4. Stainless-Steel Finishes:

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1) Run grain of directional finishes with long dimension of each piece.

2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3) Directional Satin Finish: No. 4.

4) Dull Satin Finish: No. 6.

5) Mirrorlike Reflective, Nondirectional Polish: No. 8.

c. Bright, Cold-Rolled, Unpolished Finish: No. 2B. Factory primed for field finish, **as directed**.

B. Stainless-Steel Panels
1. Provide stainless-steel panels of same construction, materials, and finish as specified for adjoining stainless-steel doors.

C. Stainless-Steel Frames
1. Description: Fabricate stainless-steel frames of construction indicated, with faces of corners mitered and contact edges closed tight.
a. Door Frames: Machine mitered, faces only welded **OR** Saw mitered and full (continuously) welded **OR** Machine mitered and full welded **OR** Knock down **OR** Slip on **OR** As indicated, **as directed**.
1) Weld frames according to HMMA 820.
b. Sidelight, Transom and Borrowed-Light Frames: Machine mitered, faces only welded **OR** Saw mitered and full (continuously) welded **OR** Machine mitered and full welded, **as directed**.
c. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from 0.062-inch- (1.59-mm-) **OR** 0.078-inch- (1.98-mm-) **OR** 0.109-inch- (2.78-mm-), **as directed**, thick, stainless-steel sheet.
d. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from 0.078-inch- (1.98-mm-) **OR** 0.109-inch- (2.78-mm-), **as directed**, thick, stainless-steel sheet.
e. Borrowed-Light Frames: Fabricate from 0.062-inch- (1.59-mm-) **OR** 0.078-inch- (1.98-mm-) **OR** 0.109-inch- (2.78-mm-), **as directed**, thick, stainless-steel sheet.
f. Sidelight and Transom Frames: Fabricate from stainless-steel sheet of same thickness as adjacent door frame.
g. Glazing and Panel Stops: Formed integral with stainless-steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.
h. Loose Stops for Glazed Lites and Panels: 0.038-inch- (0.95-mm-) thick stainless steel.
i. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 866 with reinforcing plates from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
j. Head Reinforcement: 0.109-inch- (2.78-mm-) thick, stainless-steel channel or angle stiffener for openings widths more than 48 inches (1219 mm).
k. Jamb Anchors:
1) Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.062-inch- (1.59-mm-) thick stainless steel **OR** 0.060-inch- (1.52-mm-) nominal thickness uncoated steel **OR** 0.064-inch- (1.63-mm-) nominal thickness metallic-coated steel, **as directed**, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.156 inch (4.0 mm) thick.
2) Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.050-inch- (1.27-mm-) thick stainless steel **OR** 0.048-inch- (1.21-mm-) nominal thickness uncoated steel **OR** 0.052-inch- (1.32-mm-) nominal thickness metallic-coated steel, **as directed**.
3) Compression Type for Slip-on Frames: Fabricate adjustable compression anchors from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
4) Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter, stainless-steel **OR** uncoated steel **OR** metallic-coated steel, **as directed**, bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
l. Floor Anchors: Not less than 0.078-inch- (1.98-mm-) thick stainless steel **OR** 0.075-inch- (1.90-mm-) nominal thickness uncoated steel **OR** 0.079-inch- (2.01-mm-) nominal thickness metallic-coated steel, **as directed**, and as follows:
1) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2) Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

m. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
n. Plaster Guards: Not less than 0.019-inch- (0.48-mm-) thick stainless steel **OR** 0.018-inch- (0.46-mm-) nominal thickness uncoated steel **OR** 0.022-inch- (0.56-mm-) nominal thickness metallic-coated steel, **as directed**.

2. Performance: Level A, ANSI A250.4.
3. Materials:
   a. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304 **OR** Type 316 **OR** Type 317LMN **OR** 904L, **as directed**.
   b. Steel Sheet: ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.
   c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
   d. Frame Anchors: Stainless-steel sheet. Same type as door face.
      OR
      Frame Anchors: Steel sheet **OR** Metallic-coated steel sheet, **as directed**, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
   e. Inserts, Bolts, and Anchor Fasteners: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts.
      OR
      Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
4. Finishes:
   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      1) Run grain of directional finishes with long dimension of each piece.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
      3) Directional Satin Finish: No. 4.
      4) Dull Satin Finish: No. 6.
      5) Mirrorlike Reflective, Nondirectional Polish: No. 8.
   c. Bright, Cold-Rolled, Unpolished Finish: No. 2B. Factory primed for field finish, **as directed**.

D. Accessories
1. Glazing: Comply with requirements in Division 08 Section "Glazing".
2. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.
3. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
4. Mineral Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

E. Fabrication
1. Stainless-Steel Door Fabrication: Stainless-steel doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
   a. Seamed Edge Construction: Both vertical door edges joined by visible, continuous interlocking seam (lock seam) full height of door.
      OR
      Seamed Edge Construction: Both vertical door edges joined by visible seam that is projection, spot, or tack welded on inside edges of door at minimum 6 inches (152 mm) o.c.

b. Seamless Edge Construction: Door face sheets joined at vertical edges by continuous weld extending full height of door; with edges ground and polished, providing smooth, flush surfaces with no visible seams.
c. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
d. Stops and Moldings: Factory cut openings in doors. Provide stops and moldings around glazed lites. Form corners of stops and moldings with butted or mitered hairline joints.
   1) Glazed Lites: Provide fixed stops and moldings welded on secure side of door.
   2) Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
e. Hardware Preparation: Factory prepare stainless-steel doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware".
   1) Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
f. Locate hardware as indicated, or if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
g. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 866.

2. Stainless-Steel Frame Fabrication: Fabricate stainless-steel frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
   a. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
   b. Mullions, Rails and Transom Bars: Provide closed tubular members with no visible face seams or joints. Fasten members at crossings and to jambs by butt welding according to joint designs in HMMA 820.
      1) Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.
   c. Provide countersunk, flat-, or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   d. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   e. Jamb Anchors: Provide number and spacing of anchors as follows:
      1) Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         a) Two anchors per jamb up to 60 inches (1524 mm) in height.
         b) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
         c) Four anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
         d) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
      2) Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         a) Three anchors per jamb up to 60 inches (1524 mm) in height.
         b) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
         c) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
         d) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
         e) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

3) Compression Type: Not less than two anchors in each jamb.
4) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

f. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.

g. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
1) Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
2) Double-Door Frames: Drill stop in head jamb to receive two door silencers.

h. Stops and Moldings: Provide stops and moldings around glazed lites and solid panels where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1) Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2) Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each lite is capable of being removed independently.
3) Coordinate rabbet width between fixed and removable stops with type of glazing or panel and type of installation indicated.
4) Terminated Stops: Where indicated for interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 45 **OR** 90, **as directed**,-degree angle cut, and close open end of stop with stainless-steel sheet closure. Cover opening in extension of frame with welded-stainless-steel filler plate, with welds ground smooth and flush with frame.

i. Hardware Preparation: Factory prepare stainless-steel frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware (scheduled By Describing Products)".
1) Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
2) Locate hardware as indicated, or if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

j. Plaster Guards: Weld guards to frame at back of hardware mortises and mounting holes in frames to be grouted.

k. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 866.

1.3 EXECUTION

A. Examination
1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stainless-steel doors and frames.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations of stainless-steel, door-frame connections before frame installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
2. Prior to installation and with installation spreaders in place, adjust and securely brace stainless-steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

C. Installation

1. General: Install stainless-steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with ANSI/NAAMM-HMMA 866 and manufacturer's written instructions.
2. Stainless-Steel Frames: Install stainless-steel frames of size and profile indicated.
   a. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      1) At fire-protection-rated openings, install frames according to NFPA 80.
      2) Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      3) Install frames with removable glazing stops located on secure side of opening.
      4) Install door silencers in frames before grouting.
      5) Remove temporary braces necessary for installation only after frames have been properly set and secured.
      6) Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      7) Apply corrosion-resistant coating to backs of grout-filled frames.
   b. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
      1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
   c. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
   d. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   e. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   f. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
   g. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
   h. Installation Tolerances: Adjust stainless-steel frames for squareness, alignment, twist, and plumb to the following tolerances:
      1) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      2) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
      3) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      4) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
3. Stainless-Steel Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
   a. Non-Fire-Rated Doors:

1) Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
2) Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
3) Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
4) Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

b. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
c. Smoke-Control Doors: Install doors according to NFPA 105.

4. Glazing: Install glazing in sidelights, transoms, and borrowed lights to comply with installation requirements in Division 08 Section "Glazing".
   a. Secure stops with countersunk, flat-, or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

D. Adjusting And Cleaning
1. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including stainless-steel doors or frames that are warped, bowed, or otherwise unacceptable.
2. Clean grout and other bonding material off stainless-steel doors and frames immediately after installation.
3. Stainless-Steel Touchup: Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION 08 12 13 13a

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Task	Specification	Specification Description
08 12 13 13	08 05 13 00	Steel Doors And Frames
08 13 13 13	08 05 13 00	Steel Doors And Frames
08 13 13 13	08 12 13 13a	Stainless Steel Doors And Frames
08 13 73 00	08 35 13 13	Folding Doors
08 14 00 00	06 48 13 00	Wood Doors

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SECTION 08 14 16 00 - STILE AND RAIL WOOD DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for stile and rail wood doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Exterior stile and rail wood doors and sidelites.
b. Interior stile and rail wood doors.
c. Interior fire-rated, stile and rail wood doors.
d. Interior fire-rated, wood door and sidelite frames.
e. Priming and Finishing stile and rail wood doors.
f. Fitting stile and rail wood doors to frames and machining for hardware.
g. Prehanging doors in frames.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for stile and rail wood doors complies with forest certification requirements.
1) Include statement indicating costs for each certified wood product.
b. Product Data for Credit EQ 4.4: For adhesives and composite wood materials, documentation indicating that products contain no urea formaldehyde.
3. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data.
4. Samples: Representing typical range of color and grain for each species of veneer and solid lumber required. Finish Sample with same materials proposed for factory-finished doors.

D. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Forest Certification: Provide doors made with veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
3. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B **OR** UL 10C, **as directed**.
a. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
4. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

E. Delivery, Storage, And Handling
1. Comply with manufacturer's written instructions and requirements of quality standard referenced in Part 1.2.

2. Package doors individually in opaque plastic bags or cardboard cartons.
3. Mark each door on top and bottom edge with opening number used on Shop Drawings.

F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
   a. Warranty shall be in effect during the following period of time from date of Final Completion:
      1) Exterior Doors: None **OR** One year **OR** Two years **OR** Five years, **as directed**.
      2) Interior Doors: One year **OR** Five years **OR** Life of installation, **as directed**.
      3) Insulated **OR** Insulating Leaded, **as directed**, Glass Vision Panels: Three **OR** Five, **as directed**, years.

1.2 PRODUCTS

A. Materials
1. General: Use only materials that comply with referenced standards and other requirements specified.
   a. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
   b. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
2. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea-formaldehyde resins.
3. Panel Products: Any of the following:
   a. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2.
      OR
      Particleboard made from straw, complying with ANSI A208.1, Grade M-2, except for density.
   b. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade 130.
   c. Hardboard, complying with AHA A135.4.
   d. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin.

B. Exterior Stile And Rail Wood Doors
1. Exterior Stile and Rail Wood Doors: Stock exterior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.
   a. Finish and Grade: Transparent and Premium or Select **OR** Opaque and Standard, **as directed**.
   b. Wood Species: Idaho white, lodgepole, ponderosa, or sugar pine **OR** Manufacturer's standard softwood species and cut, **as directed**.
   c. Stile and Rail Construction: Edge-glued solid lumber **OR** veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
   d. Panel Construction: Edge-glued solid lumber **OR** veneered panel product, **as directed**.
   e. Raised-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated **OR** As indicated, **as directed**.
   f. Molding Profile (Sticking): Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
   g. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass **OR** insulating-glass units made from two

lites of 3.0-mm-thick, fully tempered glass with 1/4-inch (6.4-mm) interspace, **as directed**, complying with Division 08 Section "Glazing".

h. WDMA Design Group: 1-3/4 Front Entrance Doors (Exterior) **OR** 1-3/4 Thermal (Insulated-Glass) Doors (Exterior) **OR** 8'-0" High Doors **OR** Side Lights **OR** 1-3/4 and 1-3/8 Entrance Doors (Exterior) **OR** Combination Doors **OR** Screen Doors, **as directed**.

i. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6 and grade specified. Include panel design number if applicable.

2. Exterior Stile and Rail Wood Doors: Stock **OR** Custom, **as directed**, exterior doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.

a. Panel Designs: Indicated by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.

b. Grade: Premium **OR** Custom, **as directed**.

c. Finish: Transparent **OR** Opaque, **as directed**.

d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.

e. Door Construction for Transparent Finish:

1) Stile and Rail Construction:

a) Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.

OR

Veneered, structural composite lumber or veneered, edge- and end-glued clear lumber, **as directed**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick, **as directed**.

2) Raised-Panel Construction:

a) Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.

OR

Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.

OR

Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.

OR

Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.

f. Door Construction for Opaque Finish:

1) Stile and Rail Construction: Clear softwood; may be edge glued for width and finger jointed.

OR

Stile and Rail Construction: Veneered, structural composite lumber or veneered edge- and end-glued lumber, **as directed**.

2) Raised-Panel Construction: Clear softwood lumber; edge glued for width.

OR

Raised-Panel Construction: Veneered, wood-based panel product.

g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:

1) Stiles, Top and Intermediate Rails: 5-3/8 inches (137 mm).

2) Bottom Rails: 11-3/8 inches (289 mm).

h. Raised-Panel Thickness: As indicated **OR** 1-3/4 inches (44 mm) **OR** 1-3/8 inches (35 mm) **OR** Manufacturer's standard, but not less than 1-1/8 inches (29 mm), **as directed**.
i. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
j. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass **OR** insulating-glass units made from two lites of 3.0-mm-thick, fully tempered glass with 1/4-inch (6.4-mm) interspace, **as directed**, complying with Division 08 Section "Glazing".
k. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
OR
Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
l. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

C. Interior Stile And Rail Wood Doors
1. Interior Stile and Rail Wood Doors: Stock interior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.
a. Finish and Grade: Transparent and Premium or Select **OR** Opaque and Standard, **as directed**.
b. Wood Species: Idaho white, lodgepole, ponderosa, or sugar pine **OR** Douglas fir or western hemlock, vertical sawed/sliced **OR** Red oak, quarter sawed/sliced **OR** Manufacturer's standard softwood species and cut, **as directed**.
c. Stile and Rail Construction: Edge-glued solid lumber **OR** veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
d. Raised-Panel Construction: Edge-glued solid lumber **OR** Veneered panel product **OR** shaped, medium-density fiberboard, **as directed**.
e. Flat-Panel Construction: Veneered panel product **OR** hardboard or medium-density fiberboard, **as directed**.
f. Raised-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated **OR** As indicated, **as directed**.
g. Flat-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated **OR** As indicated, **as directed**.
h. Molding Profile (Sticking): Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
i. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass, **as directed**, complying with Division 08 Section "Glazing".
j. WDMA Design Group: 1-3/8 Interior Panel Doors **OR** French Doors **OR** 8'-0" High Doors **OR** Bifold Doors, **as directed**.
k. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6 and grade specified. Include panel design number if applicable.
2. Interior Stile and Rail Wood Doors: Stock **OR** Custom, **as directed**, interior doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
a. Panel Designs: Indicated by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
b. Grade: Premium **OR** Custom, **as directed**.
c. Finish: Transparent **OR** Opaque, **as directed**.
d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced

(vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.

e. Door Construction for Transparent Finish:
   1) Stile and Rail Construction: Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
      OR
      Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered, edge- and end-glued clear lumber, **as directed**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick, **as directed**.
   2) Raised-Panel Construction: Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
      OR
      Raised-Panel Construction: Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
      OR
      Raised-Panel Construction: Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
      OR
      Raised-Panel Construction: Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
   3) Flat-Panel Construction: Veneered, wood-based panel product.

f. Door Construction for Opaque Finish:
   1) Stile and Rail Construction: Clear softwood; may be edge glued for width and finger jointed.
      OR
      Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
   2) Raised-Panel Construction: Clear softwood lumber; edge glued for width.
      OR
      Raised-Panel Construction: Shaped, medium-density fiberboard.
   3) Flat-Panel Construction: Veneered, wood-based panel product **OR** Medium-density fiberboard, **as directed**.

g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
   1) Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
   2) Bottom Rails: 9 inches (229 mm).

h. Raised-Panel Thickness: As indicated **OR** 1-3/4 inches (44 mm) **OR** 1-3/8 inches (35 mm) **OR** Manufacturer's standard, but not less than 1-1/8 inches (29 mm) **OR** Manufacturer's standard, but not less than 3/4 inch (19 mm), **as directed**.

i. Flat-Panel Thickness: As indicated **OR** 1/2 inch (13 mm) **OR** 3/8 inch (10 mm) **OR** 1/4 inch (6.4 mm), **as directed**.

j. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.

k. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass, **as directed**, complying with Division 08 Section "Glazing".

l. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
   OR
   Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

m. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

3. Interior Stile and Rail Wood Doors: Fire-rated (20-minute rating) doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
   a. Panel Designs: Indicated by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
   b. Grade: Premium **OR** Custom, **as directed**.
   c. Finish: Transparent **OR** Opaque, **as directed**.
   d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.
   e. Door Construction for Transparent Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered flat panels not less than 5/8 inch (16 mm) thick **OR** raised panels not less than 1-1/8 inches (29 mm) thick, **as directed**.
      1) Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered, edge- and end-glued clear lumber, **as directed**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick, **as directed**.
      2) Raised-Panel Construction: Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
      3) Flat-Panel Construction: Veneered, wood-based panel product.
   f. Door Construction for Opaque Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered flat panels not less than 5/8 inch (16 mm) thick **OR** raised panels not less than 1-1/8 inches (29 mm) thick, **as directed**.
      1) Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
      2) Raised-Panel Construction: Shaped, medium-density fiberboard.
      3) Flat-Panel Construction: Veneered, wood-based panel product **OR** Medium-density fiberboard, **as directed**.
   g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
      1) Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
      2) Bottom Rails: 9 inches (229 mm).
   h. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
   i. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
      OR
      Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
   j. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

4. Interior Stile and Rail Wood Doors: Fire-rated (45-minute rating) doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **as directed**, and with other requirements specified.
   a. Panel Designs: Indicate by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
   b. Grade: Premium **OR** Custom, **as directed**.
   c. Finish: Transparent **OR** Opaque, **as directed**.

d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.

e. Interior Fire-Rated Door Construction: 1-3/4-inch- (44-mm-) thick, edged and veneered mineral-core stiles and rails and 1-1/8-inch- (29-mm-) thick, veneered mineral-core raised panels.

f. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
   1) Screw-Holding Capability: 550 lbf (2440 N) **OR** 475 lbf (2110 N) **OR** 400 lbf (1780 N), **as directed**, per NWWDA T.M.-10.

g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
   1) Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
   2) Bottom Rails: 9 inches (229 mm).

h. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.

i. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
   OR
   Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

D. Interior Fire-Rated Wood Door Frames
1. Interior Fire-Rated Wood Door Frames: Frames, complete with casings **OR** sidelite frames and casings, **as directed**, fabricated from solid fire-retardant-treated wood or from veneered fire-retardant particleboard, fire-retardant medium-density fiberboard, or mineral board.
2. Species: Red oak **OR** White oak **OR** White maple **OR** Cherry, **as directed**.

E. Stile And Rail Wood Door Fabrication
1. Fabricate stile and rail wood doors in sizes indicated for field fitting.
2. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
   a. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/2 inch (13 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch (10 mm) from bottom of door to top of threshold.
      1) Comply with NFPA 80 for fire-rated doors.
   b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
   c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
3. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W Series standards, and hardware templates.
4. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable. Miter wood moldings at corner joints.
   OR
   Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 08 Section "Glazing". Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C 920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.
5. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.

6. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.
7. Prehung Doors: Provide stile and rail doors as prehung units including doors, frames, weather stripping, **as directed**, and hardware.
   a. Provide wood door frames, other than fire-rated wood door frames, that comply with Division 06 Section(s) "Interior Finish Carpentry" OR "Interior Architectural Woodwork", **as directed**.
   b. Provide hardware, including weather stripping and thresholds, that complies with Division 08 Section "Door Hardware".

F. Shop Priming
1. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting", **as directed**. Seal all four edges, edges of cutouts, and mortises with primer.
2. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section "Staining And Transparent Finishing". Seal all four edges, edges of cutouts, and mortises with first coat of finish.

G. Finishing
1. Finish wood doors at factory **OR** woodworking shop, **as directed**.
   OR
   Finish wood doors at factory **OR** woodworking shop, **as directed**, that are indicated to receive transparent finish. Wood doors that are indicated to receive opaque finish may be field finished.
   OR
   Finish wood doors at factory **OR** woodworking shop, **as directed**, where indicated in schedules or on Drawings. Wood doors that are not indicated to be factory **OR** shop, **as directed**, finished may be field finished.
2. For doors indicated to be factory **OR** shop, **as directed**, finished, comply with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
   a. Finish faces and all four edges of doors, including mortises and cutouts. Stains and fillers may be omitted on bottom **OR** top and bottom, **as directed**, edges, edges of cutouts, and mortises.
3. Transparent Finish:
   a. Grade: Premium **OR** Custom, **as directed**.
   b. Finish: AWI conversion varnish **OR** AWI catalyzed polyurethane, **as directed**, system.
      OR
      Finish: WDMA TR-4 conversion varnish **OR** WDMA TR-6 catalyzed polyurethane, **as directed**.
      OR
      Finish: WI System 4 clear conversion varnish **OR** WI System 5 catalyzed polyurethane **OR** WI System 8 UV-curable coating, **as directed**.
   c. Staining: Match sample **OR** As selected from manufacturer's full range **OR** None required, **as directed**.
   d. Effect: Open-grain finish **OR** Filled finish **OR** Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores, **as directed**.
   e. Sheen: Satin **OR** Semigloss, **as directed**.
4. Opaque Finish:
   a. Grade: Premium **OR** Custom, **as directed**.
   b. Finish: AWI conversion varnish **OR** AWI catalyzed polyurethane, **as directed**, system.
      OR
      Finish: WDMA OP-4 conversion varnish **OR** WDMA OP-6 catalyzed polyurethane, **as directed**.

OR
Finish: WI System 4 conversion varnish **OR** WI System 5 catalyzed polyurethane **OR** WI System 8 UV-curable coating, **as directed**.

c. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.

d. Sheen: Satin **OR** Semigloss **OR** Gloss, **as directed**.

1.3 EXECUTION

A. Installation

1. Install fire-rated wood door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   a. Countersink fasteners, fill surface flush, and sand smooth.
2. Hardware: For installation, see Division 08 Section "Door Hardware".
3. Install wood doors to comply with manufacturer's written instructions, WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," **OR** AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and other requirements specified.
   a. Provide WI-Certified Compliance Certificate for Installation.
   b. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
4. Field-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   a. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3 mm) **OR** 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm), **as directed**, from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6 mm) **OR** 3/8 inch (10 mm), **as directed**, from bottom of door to top of threshold.
      1) Comply with NFPA 80 for fire-rated doors.
   b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
   c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
5. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
6. Factory-Finished **OR** Shop-Finished, **as directed**, Doors: Restore finish before installation if fitting or machining is required at Project site.

B. Adjusting

1. Operation: Rehang or replace doors that do not swing or operate freely.
2. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16 00

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Task	Specification	Specification Description
08 14 16 00	08 05 13 00a	Flush Wood Doors
08 14 23 13	01 22 16 00	No Specification Required
08 14 23 16	08 05 13 00a	Flush Wood Doors
08 14 23 16	08 14 16 00	Stile And Rail Wood Doors
08 14 23 19	08 05 13 00a	Flush Wood Doors
08 14 23 19	08 14 16 00	Stile And Rail Wood Doors
08 14 66 00	01 22 16 00	No Specification Required
08 14 73 00	06 48 13 00	Wood Doors
08 14 73 00	08 05 13 00a	Flush Wood Doors

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SECTION 08 16 13 00 - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

1.1 GENERAL

A. Description of Work
1. This specification covers the furnishing and installation of materials for fiberglass reinforced plastic (FRP) doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Fire Rated Fiberglass reinforced Plastic (FRP) Doors certified by Intertek Testing Services for Warnock- Hersey in 45, 60 and 90-minute ratings, meeting all specifications of UL 10(c) fire door test standards. Category A and B.
1) Category A doors are labeled for compliance with IBC Standard (Positive Pressure) and do not require the application of an additional edge sealing system.
2) Category B doors are labeled to require the installation of a listed edge sealing system to meet the requirements of IBC Standard (Positive Pressure). This seal must be installed per the manufacturers instructions and may be factory or field applied.
3) Category B constructed doors, if requested and with certain restrictions, may be provided with an UL 10 (b) label (Negative Pressure) and at a later date can be upgraded to a UL 10 (c) category B label (Positive Pressure) with the application of a listed seal system.
b. Fire Rated Fiberglass Resin Transfer Molded Door Frames certified by Intertek Testing Services for Warnock- Hersey in 45, 60 and 90-minute ratings, meeting all specifications of UL 10(c) fire door test standards, Category C.
c. Fire Rated Fiberglass reinforced Plastic (FRP) Doors and Fiberglass Resin Transfer Molded Door Frames certified by Intertek Testing Services for Warnock- Hersey in 20, 45, 60 and 90-minute ratings, meeting all specifications of UL 10(b) fire door test standards.

C. Quality Assurance
1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a minimum of 25 years documented experience and with a record of successful in-service performance for the applications as required for this project.
2. Installer Qualifications: An experienced installer who has completed fire rated fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.
3. Source Limitations: Obtain fiberglass reinforced plastic doors and frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames.
4. Source Limitations: Hardware and accessories for all FRP doors as specified in Division 08 Section "Door Hardware" should be provided and installed by the fiberglass door and frame manufacturer.
5. Source Limitations: Glass for windows in doors shall be furnished and installed by door and frame manufacturer in accordance with related section, Division 08 Section "Glazing".

D. Submittals
1. Product technical data including:
a. Acknowledgment that products submitted meet requirements of standards referenced
b. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.
c. Manufacturer's installation instructions.

d. Schedule of doors and frames indicating the specific reference numbers as used on drawings, door type, frame type, size, handing and applicable hardware.
e. Details of core and edge construction. Include factory-construction specifications.
f. Certification of manufacturer's qualifications.

2. Submittal drawings for customer approval shall be submitted prior to manufacture and will include the following information and formatting.
   a. Summary door schedule indicating the specific reference numbers as used on owner's drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
   b. A drawing depicting front and rear door elevations showing hardware with bill of material for each door.
   c. Drawing showing dimensional location of each hardware item and size of each door.
   d. Individual part drawing and specifications for each hardware item and FRP part or product.
   e. Construction and mounting detail for each frame type.
3. Samples:
   a. Provide one 21 x 18 inch completely assembled (hinged) door and frame corner section, with faces and edges representing typical color and finish. One edge should be exposed for view of interior door and frame composition.
4. Operation and Maintenance Manuals:
   a. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use conditions.
   b. Include one set of final as built drawings with the same requirements as mentioned above.
   c. Include certificate of warranty for door and frame listing specific door registration numbers.
   d. Include hardware data sheets and hardware manufacturer's warranties.

E. Delivery, Storage, And Handling
1. Each door and frame should be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate should contain all fasteners necessary for installation as well as complete installation instructions.
2. Doors should be stored in the original container out of inclement weather for protection against the elements.
3. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.

F. Warranty
1. Warranty all fiberglass doors and frames for a period of 25 years against failure due to corrosion. Additionally, warranty all fiberglass doors and frames on materials and workmanship for a period of 10 years, including warp, separation or delamination, and expansion of the core.

1.2 PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Chem-Pruf Door Co., Ltd., P.O. Box 4560, Brownsville, Texas 78523 Phone: 1-800-444-6924, Fax: 956-544-7943, Website: www.chem-pruf.com
2. Substitutions may be considered, provided manufacturer can comply with the specifications as written herein. Requests for substitution must be submitted in writing no less than 10 days prior to bid date.

B. FRP Doors
1. Fire rated Fiberglass reinforced Plastic (FRP) Doors certified by Intertek Testing Services for Warnock-Hersey in 20, 45, 60 and 90 minute ratings meeting all specifications of UL 10(c) and UL 10(b) fire door test standards.

2. Doors shall be made of fiberglass reinforced plastic (FRP) using chemically proven fire retardant resins resistant to contaminants typically found in the environment for which these specifications are written. Doors shall be 1-3/4 inch thick and of flush construction, having no seams or cracks. All doors up to 4'-0 x 8'-0 shall have equal diagonal measurements with a maximum tolerance of +/-1/32 inch.
3. Door Plates shall be molded in one continuous piece, starting with a 25-mil gelcoat of the color specified, integrally molded with at least two layers of 1.5 ounce per square foot fiberglass. This will yield a plate ratio of 30/70 glass to resin.
4. Stiles and Rails Core shall be banded with firestop per factory drawings.
5. Core material shall be fire resistant mineral core placed within band structure allowing no voids within.
6. Finish of door and frame shall be identical in color and texture. At time of manufacture, 25 mil of resinrich gelcoat must be integrally molded into both the door and frame. Secondary painting to achieve color is not acceptable.
7. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Window kits shall be fire rated per U.L. for rating of opening and function.

C. Frames
1. Frames shall be fiberglass and manufactured using the resin transfer method in closed rigid molds to assure uniformity in color and size. Beginning with a minimum 25-mil gel coat and a minimum of two layers continuous strand fiberglass mat saturated with fire retardant resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core of firestop and mineral core. Frames must be fiberglass. Frames of dissimilar materials, such as metal or stainless steel will not be accepted.
2. Finish of frame shall be identical in color and texture to the door. 25-mil resin rich gel coat will be integrally molded into the frame at time of manufacture. Secondary painting to achieve color is not acceptable.
3. Jamb/Header connection shall be coped by CNC for tight fit.
4. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware.
5. Mortises for hardware shall be accurately machined by CNC to hold dimensions in all three axis.
6. Hinge pockets shall be accurately machined by CNC to facilitate heavy-duty hinges at all hinge locations, using spacers when standard weight hinges are used.

D. Hardware
1. See Division 08 Section "Door Hardware".
2. Due to the special nature of the material in this section, all related hardware as specified must be furnished and installed by the door and frame manufacturer.

1.3 EXECUTION

A. Installation Conditions
1. Verification of Conditions
   a. Openings are correctly prepared to receive doors and frames.
   b. Openings are correct size and depth in accordance with shop drawings or submittals.
2. Installer's Examination
   a. Have the installer examine conditions under which construction activities of this section are to be performed and submit a written report if conditions are unacceptable.
   b. Transmit two copies of the installer's report to the architect within 24 hours of receipt.
   c. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

B. Installation

1. Install door-opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
2. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
3. Site tolerances: Maintain plumb and level tolerance specified in manufacturers printed installation instructions.
4. Fire labeled doors and frames must be installed in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.
5. UL 10 (c) Category B doors require field-applied seal per manufacture's instructions.

C. Adjusting
1. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
2. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

D. Cleaning
1. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

E. Protection Of Installed Products
1. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 08 16 13 00

Task	Specification	Specification Description
08 16 13 00	08 05 13 00	Steel Doors And Frames
08 16 13 00	08 12 13 13	Steel Entry Doors
08 16 13 00	08 12 13 13a	Stainless Steel Doors And Frames
08 17 23 00	06 48 13 00	Wood Doors
08 17 23 00	08 05 13 00a	Flush Wood Doors

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SECTION 08 31 13 00 - ACCESS DOORS AND FRAMES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for access doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Access doors and frames for walls and ceilings.
b. Floor access doors and frames.

C. Submittals
1. Product Data: For each type of access door and frame indicated.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each door face material in specified finish.
4. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

D. Quality Assurance
1. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
a. NFPA 252 or UL 10B for vertical access doors and frames.
b. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.2 PRODUCTS

A. Steel Materials
1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
a. ASTM A 123/A 123M, for galvanizing steel and iron products.
b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
2. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
a. ASTM A 123/A 123M, for galvanizing steel and iron products
b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
3. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
4. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating.
5. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
a. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
b. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds,

mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1) Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

c. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

d. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

e. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

6. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

7. Plaster Beads: Casing bead formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

B. Stainless-Steel Materials

1. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 **OR** 316 **OR** Type 317LMN **OR** 904L, **as directed**. Remove tool and die marks and stretch lines or blend into finish.

a. Finish: Directional Satin Finish, No. 4 **OR** Manufacturer's standard, **as directed**.

C. Aluminum Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6, mill finish.

2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6, mill finish.

3. Aluminum Sheet: ASTM B 209 (ASTM B 209M).

a. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

b. Anodic Finish: Class II, clear anodic coating complying with AAMA 611 **OR** Class I, clear anodic coating complying with AAMA 611, **as directed**.

c. Baked-Enamel Finish: Manufacturer's standard.

D. Access Doors And Frames For Walls And Ceilings

1. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.

a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.

b. Door: Minimum 0.060-inch- (1.5-mm-), **as directed,** thick sheet metal, set flush with exposed face flange of frame.

c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.

d. Hinges: Spring-loaded, concealed-pin type **OR** Continuous piano, **as directed**.

e. Latch: Cam latch **OR** Slam latch **OR** Self-latching bolt, **as directed**, operated by screwdriver **OR** knurled knob **OR** hex head wrench **OR** pinned hex head wrench **OR** spanner head wrench **OR** flush key **OR** ring turn, **as directed**, with interior release.

f. Lock: Cylinder **OR** Mortise cylinder, **as directed**.

1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

2. Flush Access Doors and Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.

a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.

b. Door: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal, set flush with surrounding finish surfaces.

c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with drywall **OR** plaster, **as directed**, bead flange.
d. Hinges: Spring-loaded, concealed-pin type **OR** Continuous piano, **as directed**.
e. Latch: Cam latch **OR** Slam latch **OR** Self-latching bolt, **as directed**, operated by screwdriver **OR** knurled knob **OR** hex head wrench **OR** pinned hex head wrench **OR** spanner head wrench **OR** flush key **OR** ring turn, **as directed**, with interior release.
f. Lock: Cylinder **OR** Mortise cylinder, **as directed**.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

3. Recessed Access Doors and Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
b. Door: Minimum 0.060-inch- (1.5-mm-), **as directed,** thick sheet metal in the form of a pan recessed 5/8 inch (16 mm) **OR** 1 inch (25 mm), **as directed**, for gypsum board **OR** plaster **OR** acoustical tile, **as directed**, infill.
c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with drywall bead for gypsum board surfaces **OR** with plaster bead for plaster surfaces **OR** designed for insertion into acoustical tile ceiling, **as directed**.
d. Hinges: Spring-loaded, concealed-pin type **OR** Concealed pivoting rod hinge, **as directed**.
e. Latch: Cam latch **OR** Slam latch **OR** Self-latching bolt, **as directed**, operated by screwdriver **OR** knurled knob **OR** hex head wrench **OR** pinned hex head wrench **OR** spanner head wrench **OR** flush key **OR** ring turn, **as directed**, with interior release.
f. Lock: Cylinder **OR** Mortise cylinder, **as directed**.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

4. Aluminum Flush Access Doors and Frames with Exposed Trim: Fabricated from aluminum sheet and extruded-aluminum shapes.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
b. Door: Minimum 0.080-inch- (2.0-mm-), **as directed**, thick aluminum sheet.
c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick extruded aluminum with 1-1/4-inch- (32-mm-) wide rolled flange.
d. Hinges: Concealed continuous aluminum.
e. Latch: Screwdriver-operated cam latch.

5. Lightweight Flush Access Doors and Frames with Exposed Trim: Fabricated from lightweight metal.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
b. Door: Minimum 0.018-inch- (0.45-mm-) thick steel sheet.
c. Frame: Minimum 0.045-inch- (1.1-mm-) thick extruded aluminum with 1-1/4-inch- (32-mm-) wide rolled flange.
d. Hinges: Continuous piano.
e. Latch: Screwdriver-operated cam latch.

6. Plastic Flush Access Doors and Frames with Exposed Trim: Fabricated from 1/8-inch- (3.2-mm-) thick high-impact plastic with UV stabilizer.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
b. Door: Flush to frame with rounded corners.
c. Frame: 1 piece, 3/4 inch (19 mm) deep.
d. Latch: Snap latch.
e. Finish: White with textured exposed surfaces.

7. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
b. Door: Minimum 0.040-inch- (1.0-mm-), **as directed**, thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- (50-mm-) thick fiberglass insulation.
c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick extruded aluminum.
d. Hinges: Continuous piano, zinc plated.

e. Lock: Dual-action handles with key lock.

8. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
   a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
   b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
   c. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
   d. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm), **as directed**.
   e. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with 1-inch- (25-mm-), **as directed,** wide, surface-mounted trim.
   f. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
   g. Automatic Closer: Spring type.
   h. Latch: Self-latching device operated by knurled knob **OR** flush key **OR** ring turn, **as directed**, with interior release.
   i. Lock: Self-latching device with cylinder **OR** mortise cylinder, **as directed**, lock.
      1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

9. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
   a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
   b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
   c. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
   d. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm), **as directed**.
   e. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with drywall **OR** plaster, **as directed**, bead.
   f. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
   g. Automatic Closer: Spring type.
   h. Latch: Self-latching device operated by knurled knob **OR** flush key **OR** ring turn, **as directed**, with interior release.
   i. Lock: Self-latching device with cylinder **OR** mortise cylinder, **as directed**, lock.
      1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

10. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
    a. Locations: Wall surfaces.
    b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
    c. Door: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal, flush construction.
    d. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
    e. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
    f. Automatic Closer: Spring type.
    g. Latch: Self-latching device operated by knurled knob **OR** flush key **OR** ring turn, **as directed**, with interior release.
    h. Lock: Self-latching device with cylinder **OR** mortise cylinder, **as directed**, lock.
       1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

11. Medium-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
    a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
    b. Door: Minimum 0.105-inch- (2.7-mm-) thick sheet metal, flush construction.

c. Frame: Minimum 0.105-inch- (2.7-mm-) thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
d. Hinges: Concealed continuous piano.
e. Lock: Detention.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

12. Medium-Security, Flush Access Doors with Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
b. Door: Minimum 0.105-inch- (2.7-mm-) thick sheet metal, flush construction.
c. Frame: Minimum 0.105-inch- (2.7-mm-) thick sheet metal with drywall **OR** plaster, **as directed**, bead.
d. Hinges: Concealed continuous piano.
e. Lock: Detention.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

13. High-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed,** sheet and angles.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed,** surfaces.
b. Door: Minimum 0.135-inch- (3.4-mm-) thick sheet metal, flush construction.
c. Frame: Minimum 3/16-by-2-by-2-inch (4.7-by-50-by-50-mm) angle welded with joints ground smooth.
d. Hinges: Heavy-duty steel welded to door and frame.
e. Lock: Heavy-duty, detention deadbolt.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

14. Maximum-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet and angles.
a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed,** surfaces.
b. Door: Minimum 0.180-inch- (4.55-mm-) thick sheet metal, flush construction.
c. Frame: Minimum 3/16-by-2-by-2-by-3-inch (4.7-by-50-by-50-by-76-mm) angle welded with joints ground smooth.
d. Hinges: Heavy-duty steel welded to door and frame.
e. Lock: Heavy-duty detention deadbolt.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

15. Fire-Rated, Insulated, Medium-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed,** sheet.
a. Locations: Wall surfaces.
b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
c. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
d. Door: Flush panel with a core of 2-inch- (50-mm-) thick, mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.075 inch (1.9 mm).
e. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
f. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
g. Automatic Closer: Spring type.
h. Lock: Self-latching device with detention lock.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

16. Fire-Rated, Insulated, Medium-Security, Flush Access Doors with Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed,** sheet.
a. Locations: Wall surfaces.
b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.

c. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
d. Door: Flush panel with a core of 2-inch- (50-mm-) thick, mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.075 inch (1.9 mm).
e. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall **OR** plaster, **as directed**, bead.
f. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
g. Automatic Closer: Spring type.
h. Lock: Self-latching device with detention lock.
1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

E. Floor Access Doors And Frames
1. Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.
2. Aluminum Floor Door: Single **OR** Double, **as directed,**-leaf opening. Extruded-aluminum angle frame with 1/4-inch- (6.4-mm-) thick, diamond-pattern, aluminum tread plate door; nonwatertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live load **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load **OR** AASHTO H20 concentrated wheel load, without impact, **as directed**.
3. Watertight Aluminum Floor Door: Single **OR** Double, **as directed,**-leaf opening. Extruded-aluminum gutter frame with NPS 1-1/2 (DN 40) drainage coupling and 1/4-inch- (6.4-mm-) thick, diamond-pattern, aluminum tread plate door; watertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live load **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load **OR** AASHTO H20 concentrated wheel load, without impact, **as directed**.
4. Steel Angle-Frame Floor Door: Single **OR** Double, **as directed,**-leaf opening. Prime-painted structural **OR** Galvanized structural **OR** Stainless, **as directed**,-steel frame with 3/16- or 1/4-inch- (4.8- or 6.4-mm-) **OR** 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, thick, diamond-pattern, prime-painted structural **OR** galvanized structural **OR** stainless, **as directed,**-steel tread plate door; nonwatertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live **OR** AASHTO H20 concentrated wheel, **as directed**, load.
a. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
b. Finish painted in yellow with wording "FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE."
5. Watertight Steel Gutter-Frame Floor Door: Single **OR** Double, **as directed**,-leaf opening. Prime-painted structural **OR** Galvanized structural **OR** Stainless, **as directed**,-steel channel frame forming gutter with NPS 1-1/2 (DN 40) drainage coupling and 3/16- or 1/4-inch- (4.8- or 6.4-mm-) **OR** 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, thick, diamond-pattern, prime-painted structural **OR** galvanized structural **OR** stainless, **as directed**,-steel tread plate door; watertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live **OR** AASHTO H20 concentrated wheel, **as directed**, load.
a. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
b. Finish painted in yellow with wording "FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE."
6. Hardware: Provide the following:
a. Hinges: Heavy-duty, zinc-coated steel **OR** aluminum **OR** stainless-steel **OR** brass, **as directed**, butt hinges with stainless-steel pins.
b. Latch: Stainless-steel slam latch.
c. Lock: Staple for a padlock **OR** Recessed hasp **OR** Keyed deadlock bolt **OR** Hasp and staple, **as directed**.

d. Hardware Material: Manufacturer's standard **OR** Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners, **as directed**.

7. Insulation: Fiberglass **OR** Urethane, **as directed**, with liner pan.
8. Safety Accessories: Safety chains **OR** net **OR** railing, **as directed**.

F. Fabrication

1. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
2. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
3. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
4. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
5. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   a. For cylinder lock, furnish two keys per lock and key all locks alike.
   b. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
6. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

1.3 EXECUTION

A. Installation

1. Comply with manufacturer's written instructions for installing access doors and frames.
2. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
3. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

B. Adjusting And Cleaning

1. Adjust doors and hardware after installation for proper operation.
2. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13 00

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SECTION 08 32 13 00 - SLIDING ALUMINUM-FRAMED GLASS DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for sliding aluminum-framed glass doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes sliding aluminum-framed glass doors for exterior locations.

C. Performance Requirements
1. General: Provide sliding aluminum-framed glass doors capable of complying with performance requirements indicated, based on testing manufacturer's sliding doors that are representative of those specified, and that are of minimum test size indicated below:
   a. Size required by AAMA/WDMA/CSA 101/I.S.2/A440 for gateway performance **OR** optional performance grade **OR** gateway performance for both gateway performance and optional performance grade, **as directed**.
      OR
      Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide sliding aluminum-framed glass doors capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural Test:
   a. Design Wind Loads: Determine design wind loads under conditions indicated according to ASCE/SEI 7.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
      2) Importance Factor.
      3) Exposure Category: B **OR** C **OR** D, **as directed**.
   b. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Deflection Test, or structural computations.
3. Windborne-Debris Resistance: Provide sliding aluminum-framed glass doors capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing sliding aluminum-frames glass doors identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
2. Shop Drawings: For sliding aluminum-framed glass doors. Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and the following:
   a. Mullion details for fenestration combinations including reinforcement and stiffeners.
   b. Joinery details.
   c. Expansion provisions.

d. Flashing and drainage details.
e. Weather-stripping details.
f. Thermal-break details.
g. Glazing details.
h. Accessories.

3. Samples: For sliding aluminum-framed glass doors and components required, prepared on Samples of size indicated below:
   a. Main Framing Member: 12-inch- (300-mm-) long section with weather stripping, **as directed**, glazing bead and factory-applied color finish.
   b. Hardware: Full-size units with factory-applied finish.
4. Delegated-Design Submittal: For sliding aluminum-framed glass doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
   a. Structural test pressures and design pressures from wind loads indicated.
   b. Deflection limitations of glass framing systems.
5. Qualification Data: For qualified Installer, manufacturer, professional engineer and testing agency.
6. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each class, grade, and size of sliding aluminum-framed glass door. Test results based on use of downsized test doors will not be accepted, **as directed**.
7. Field quality-control reports.
8. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.
9. Warranty: Sample of special warranty.

E. Quality Assurance
1. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
2. Installer Qualifications: An installer acceptable to sliding door manufacturer for installation of units required for this Project.
   a. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for sliding aluminum-framed glass doors, including Shop Drawings and Designated-Design Submittal, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Source Limitations: Obtain sliding aluminum-framed glass doors from single source from single manufacturer.
4. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of sliding aluminum-framed glass doors. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   OR
   Product Options: Drawings indicate size, profiles, and dimensional requirements of sliding aluminum-framed glass doors and are based on the specific system indicated. Do not modify size and dimensional requirements.
   a. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
5. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, "Standard/Specification for Windows, Doors, and Unit Skylights," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

a. Provide AAMA **OR** WDMA, **as directed**,-certified, sliding aluminum-framed glass doors with an attached label.

6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
   a. Subject to compliance with requirements, permanently mark safety glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction.
7. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
8. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions
1. Field Measurements: Verify actual dimensions of sliding aluminum-framed glass door openings by field measurements before fabrication.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Failure to meet performance requirements.
      2) Structural failures including excessive deflection.
      3) Water leakage or air infiltration.
      4) Faulty operation of movable sash and hardware.
      5) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      6) Deterioration of insulating glass and laminated glass as defined in Division 8 Section "Glazing."
   b. Warranty Period:
      1) Sliding Door: Three **OR** Five, **as directed**, years from date of Final Completion.
      2) Glazing: 10 **OR** 20, **as directed**, years from date of Final Completion.
      3) Metal Finish: Five **OR** 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum Extrusions: Provide alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.
2. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive for SC 3 severe service conditions and compatible with members, trim, hardware, anchors, and other components of sliding aluminum-framed glass doors. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.
   a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
3. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
4. Reinforcing Members: Provide aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel reinforcing members that are noncorrosive for SC 3 severe service conditions and that comply with AAMA/WDMA/CSA 101/I.S.2/A440; provide sufficient strength to withstand design pressure indicated.

5. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when sliding aluminum-framed glass door is closed.
   a. Weather-Stripping Material: Closed-cell elastomeric, preformed gaskets complying with ASTM C 509.
      OR
      Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
      OR
      Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440.
6. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.
   a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 702.
7. Sealant: For sealants required within fabricated sliding doors, provide sliding aluminum-framed glass door manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

B. Sliding Door
1. AAMA/WDMA/CSA Performance Requirements: Provide sliding aluminum-framed glass doors of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 unless more stringent performance requirements are indicated.
   a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
   b. Performance Class and Grade: LC25 **OR** 30 **OR** 35, **as directed**.
   c. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
   d. Performance Class and Grade: HC40 **OR** 45 **OR** 50, **as directed**.
   e. Performance Class and Grade: AW40 **OR** 45 **OR** 50, **as directed**.
   f. Performance Class and Grade: As indicated.
2. Condensation Resistance: Provide sliding aluminum-framed glass doors with a minimum CRF when tested according to AAMA 1503 **OR** CR determined according to NFRC 500, **as directed**, of 45 **OR** 52, **as directed**.
3. Thermal Transmittance: Provide sliding aluminum-framed glass doors with a maximum whole fenestration product U-factor indicated, when tested according to AAMA 1503 **OR** determined according to ASTM E 1423 **OR** determined according to NFRC 100, **as directed**.
   a. U-Factor: 0.35 **OR** 0.40 **OR** 0.65, **as directed**, Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient (SHGC): Provide sliding aluminum-framed glass doors with a whole-fenestration product SHGC maximum of 0.40 **OR** 0.55, **as directed**, determined according to NFRC 200.
5. Acoustical Performance: Provide sliding aluminum-framed glass doors with an STC **OR** OITC, **as directed**, rating of 29 **OR** 34, **as directed**, when tested according to and determined by ASTM E 90 and ASTM E 413 **OR** ASTM E 1425 and ASTM E 1332, **as directed**, respectively.
6. Air Leakage Resistance: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Air Leakage Resistance Test.
   a. Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 1.6 lbf/sq. ft. (75 Pa), [equivalent to 25-mph (11-m/s) wind speed and typically used to test R, C, LC, and HC (sliding seal units) performance classes].
      OR
      Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 6.2 lbf/sq. ft. (300 Pa)., [equivalent to a 50-mph (22-m/s) wind speed and typically used to test AW (sliding seal units) performance classes].
7. Water Penetration Resistance: No water leakage as defined in the AAMA/WDMA/CSA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Water Penetration Resistance Test.

a. Test Pressure: 15 percent of positive design pressure, but not less than 2.9 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa), (if performance equal to minimum for all other classes set by AAMA/WDMA/CSA 101/I.S.2/A440 is required).
b. Test Pressure: 20 percent of positive design pressure, but not more than 12 lbf/sq. ft. (580 Pa), (if performance equal to minimum for AW class sliding doors set by AAMA/WDMA/CSA 101/I.S.2/A440 is required).

8. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 842 (if AAMA/WDMA/CSA 101/I.S.2/A440 is the method selected for specifying sliding door performance).
9. Life-Cycle Testing (for AW class sliding doors only): Tested according to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.
10. Operating Force and Auxiliary (Durability) Tests: Tested according to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Glazing
1. Glass and Glazing System: Comply with Division 08 Section "Glazing" for safety glass, insulating-glass units, laminated glass, and glazing requirements applicable to glazed sliding aluminum-framed glass doors.

D. Hardware
1. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.

E. Insect Screens
1. General: Design sliding aluminum-framed glass doors and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with door frame. Locate screens on the inside **OR** outside, **as directed**, of door and provide for each operable door panel. Comply with SMA 1201.
2. Insect Screen Frames: Manufacturer's standard extruded-aluminum **OR** formed-tubular-aluminum, **as directed**, members, with mitered or coped joints, concealed fasteners, adjustable rollers, and removable PVC or PE spline/anchor concealing edge of mesh.
a. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
OR
Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
OR
Finish: Manufacturer's standard.
3. Glass-Fiber Mesh Fabric: ASTM D 3656, 18-by-14 or 18-by-16 **OR** 20-by-20 or 20-by-30, **as directed**, count per sq. in. (645-sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.
a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
4. Aluminum Wire Fabric: 18-by-16 count per sq. in. (645-sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
5. Hardware: Extruded, cast, or wrought aluminum **OR** Die-cast zinc with special coating finish **OR** Cadmium-plated steel **OR** Zinc-plated steel **OR** Nonmagnetic stainless steel, **as directed**.
a. Lock: Manufacturer's standard pull and keyless locking device on each movable panel, lockable from inside only. Adjust locking device to allow unobstructed movement of panel across adjacent panel in direction indicated.

F. Fabrication
1. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
2. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

3. Thermally Improved Construction: Fabricate sliding aluminum-framed glass doors with an integral, concealed, low-conductance thermal barrier; locate between exterior materials and door members exposed on interior side, and in a manner that eliminates direct metal-to-metal contact.
   a. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
   b. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
   c. Provide hardware with low conductivity, or provide nonmetallic material for hardware bridging thermal breaks at frame.
4. Weather Stripping: Provide operable panels with a double row of sliding weather stripping in horizontal rails and single-row **OR** double-row, **as directed**, weather stripping in meeting or jamb stiles. Provide compression-type weather stripping at the perimeter of each movable panel where sliding-type weather stripping is not appropriate.
   a. Provide weather stripping locked into extruded grooves in door panels or frames.
5. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.
6. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.
7. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames.

G. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. High-Performance Organic Finish: Three **OR** Four, **as directed**,-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination
1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
c. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
2. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
3. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding aluminum-framed glass door installation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
2. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
4. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.
5. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."

C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Tests and Inspections:
a. Testing Methodology: Testing of sliding aluminum-framed glass doors for air penetration resistance and water resistance will be performed according to AAMA 502, Test Method A **OR** Test Method B, **as directed**, by applying same test pressures required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440.
b. Testing Extent: Three sliding aluminum-framed glass doors as selected by the Owner and a qualified independent testing and inspecting agency. Sliding doors shall be tested immediately after installation.
3. Sliding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports according to AAMA 502. Testing agency will interpret test results and state in each report whether tested work complies with or deviates from requirements.

D. Adjusting, Cleaning, And Protection
1. Lubricate hardware and moving parts.

2. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure.
3. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
4. Clean aluminum surfaces immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, and clean surfaces.
5. Clean glass immediately after installing sliding aluminum-framed glass doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
7. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. During construction, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written instructions.
8. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.
9. Replace damaged components.

END OF SECTION 08 32 13 00

SECTION 08 32 19 00 - SLIDING WOOD-FRAMED GLASS DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sliding wood-framed glass doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes sliding wood-framed glass doors for exterior locations with bare, unfinished **OR** prime-coated **OR** finish-coated **OR** aluminum-clad **OR** vinyl-clad, **as directed**, exterior exposed surfaces.

C. Performance Requirements

1. General: Provide sliding wood-framed glass doors capable of complying with performance requirements indicated based on testing manufacturers' sliding doors that are representative of those specified and that are of test size indicated below:
   a. Size required by AAMA/WDMA/CSA 101/I.S.2/A440 for gateway performance **OR** optional performance grade **OR** gateway performance for both gateway performance and optional performance grade, **as directed**.
      OR
      Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide sliding wood-framed doors capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural Test:
   a. Design Wind Loads: Determine design wind loads according to ASCE/SEI 7.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
      2) Importance Factor.
      3) Exposure Category: B **OR** C **OR** D, **as directed**.
   b. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Deflection Test, or structural computations.
3. Windborne-Debris Resistance: Provide glazed sliding doors capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed sliding doors identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
2. LEED Submittal:
   a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that sliding wood-framed glass doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body and statement indicating costs for each certified wood product.
3. Shop Drawings: For sliding wood-framed glass doors. Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and the following:
   a. Mullion details for fenestration combinations including reinforcement and stiffeners.
   b. Joinery details.

c. Expansion provisions.
d. Flashing and drainage details.
e. Weather-stripping details.
f. Glazing details.
g. Accessories.

4. Samples: For sliding wood-framed glass doors and components required, prepared on Samples of size indicated below:
   a. Main Framing Member: 12-inch- (300-mm-) long section with weather stripping, **as directed**, glazing bead and factory-applied color finish.
   b. Hardware: Full-size units with factory-applied finish.
5. Delegated-Design Submittal: For sliding wood-framed glass doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
   a. Structural test pressures and design pressures from wind loads indicated.
   b. Deflection limitations of glass framing systems.
6. Qualification Data: For qualified Installer, manufacturer and professional engineer.
7. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each class, grade, and size of sliding wood-framed glass doors. Test results based on use of downsized test doors will not be accepted, **as directed**.
8. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.
9. Warranty: Sample of special warranty.

E. Quality Assurance
1. Manufacturer Qualifications: A manufacturer capable of fabricating sliding wood-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
2. Installer Qualifications: An installer acceptable to sliding door manufacturer for installation of units required for this Project.
   a. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for sliding wood-framed glass doors, including Shop Drawings and Designated-Design Submittal, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Source Limitations: Obtain sliding wood-framed glass doors from single source from single manufacturer.
4. Forest Certification: Fabricate products from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
5. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, "Standard/Specification for Windows, Doors, and Unit Skylights," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   a. Provide AAMA **OR** WDMA, **as directed**,-certified, sliding wood-framed glass doors with an attached label.
6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
   a. Subject to compliance with requirements, permanently mark safety glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction.
7. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

F. Delivery, Storage, And Handling

1. Protect sliding doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store off ground and covered in a clean, dry, well-ventilated, protected space. Comply with manufacturer's written instructions.

G. Project Conditions
1. Field Measurements: Verify sliding wood-framed glass door openings by field measurements before fabrication and indicate measurements on Shop Drawings.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sliding wood-framed glass doors that fail in materials or workmanship within specified warranty period.
a. Failures include, but are not limited to, the following:
1) Failure to meet performance requirements.
2) Structural failures including excessive deflection.
3) Water leakage or air infiltration.
4) Faulty operation of movable panels and hardware.
5) Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.
6) Deterioration of insulating glass and laminated glass as defined in Division 08 Section "Glazing".
b. Warranty Period:
1) Sliding Door: Two **OR** Three, **as directed**, years from date of Final Completion.
2) Glazing: 10 **OR** 20, **as directed**, years from date of Final Completion.
3) Metal Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Wood: Clear fir or pine or another suitable fine-grained lumber; kiln-dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
2. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by sliding wood-framed glass door manufacturer for strength, corrosion resistance, and application of required finish.
a. Baked-Enamel Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1) Color and Gloss: White **OR** Bronze **OR** Brown **OR** Beige **OR** Gray **OR** Green **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
b. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 620 **OR** AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
3. Vinyl Cladding: Consisting of a rigid PVC sheath made from PVC complying with ASTM D 4726, not less than 35-mil (0.9-mm) average thickness, in permanent, integral color, white **OR** bronze **OR** tan, **as directed**, finish, and mechanically bonded to exterior wood frame members.
4. Wood Trim and Glazing Stops: Material and finish to match frame members.
OR

Clad Trim and Glazing Stops: Hollow extrusions; **OR** Roll-formed sheet; **OR** Clad-wood material; **OR** Material and, **as directed**, finish to match clad frame members.

5. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive for SC 3 severe service conditions and compatible with sliding wood-framed glass door members, cladding, trim, hardware, anchors, and other components.
   a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
6. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
7. Integral Fin: PVC or extruded- or rolled-aluminum nailing fins for securing frame to structure; provide sufficient strength to withstand design pressure indicated.
8. Mullions: Provide mullions and mullion casing and cover plates as shown, matching door units, complete with anchors for support to structure and installation of sliding wood-framed glass door units. Allow for erection tolerances and provide for movement of door units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of door units.
9. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
10. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when sliding wood-framed glass door is closed.
    a. Weather-Stripping Material: Closed-cell elastomeric, preformed gaskets complying with ASTM C 509.
       OR
       Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
       OR
       Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440.
11. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.
    a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 702.
12. Drip Caps: Extruded aluminum, factory fabricated and finished to match aluminum cladding; designed to direct water away from building when installed horizontally at head of aluminum-clad sliding wood-framed glass door units.

B. Sliding Door

1. AAMA/WDMA/CSA Performance Requirements: Provide sliding wood-framed glass doors of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 unless more stringent performance requirements are indicated.
   a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
   b. Performance Class and Grade: LC25 **OR** 30 **OR** 35, **as directed**.
   c. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
   d. Performance Class and Grade: As indicated.
2. Thermal Transmittance: Provide sliding wood-framed glass doors with a whole-fenestration-product U-factor maximum indicated, when tested according to AAMA 1503 **OR** determined according to ASTM E 1423 **OR** determined according to NFRC 100, **as directed**.
   a. U-Factor: 0.54 Btu/sq. ft. x h x deg F (3.06 W/sq. m x K) for unfinished sliding wood-framed glass doors with clear, 3/4-inch (19-mm) insulating glass.
   b. U-Factor: 0.56 Btu/sq. ft. x h x deg F (3.17 W/sq. m x K) for aluminum-clad sliding wood-framed glass doors with clear, 3/4-inch (19-mm) insulating glass.

c. U-Factor: 0.38 Btu/sq. ft. x h x deg F (2.15 W/sq. m x K) for unfinished sliding wood-framed glass doors with low-E coated, clear, 3/4-inch (19-mm) insulating glass.
d. U-Factor: 0.38 Btu/sq. ft. x h x deg F (2.15 W/sq. m x K) for aluminum-clad sliding wood-framed glass doors with low-E coated, clear, 3/4-inch (19-mm) insulating glass.

3. Solar Heat-Gain Coefficient (SHGC): Provide sliding wood-framed glass doors with a whole-window SHGC maximum of 0.40 **OR** 0.55, **as directed**, determined according to NFRC 200.
4. Air-Leakage Resistance: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Air Leakage Resistance Test.
   a. Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 1.6 lbf/sq. ft. (75 Pa), [equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes].
5. Water-Penetration Resistance: No water leakage as defined in AAMA/WDMA/CSA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Water Penetration Resistance Test.
   a. Test Pressure: 15 percent of positive design pressure, but not less than 2.9 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa).
6. Forced-Entry Resistance (if AAMA/WDMA/CSA 101/I.S.2/A440 is the method selected for specifying sliding door performance): Comply with Performance Grade 10 requirements when tested according to ASTM F 842.
7. Operating Force and Auxiliary (Durability) Tests: Tested according to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Glazing
1. Glass and Glazing System: Comply with Division 08 Section "Glazing" for safety glass, insulating-glass units, laminated glass, and glazing requirements applicable to glazed sliding wood-framed glass doors.

D. Hardware
1. Comply with AAMA/WDMA/CSA 101/I.S.2/A440

E. Insect Screens
1. General: Design sliding doors and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with door frame. Locate screens on the inside **OR** outside, **as directed**, of door and provide for each operable door panel. Comply with SMA 1201.
2. Insect Screen Frames: Manufacturer's standard extruded-aluminum or formed-tubular-aluminum members, with mitered or coped joints, concealed fasteners, adjustable rollers, and removable PVC or PE spline/anchor concealing edge of mesh.
   a. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
   OR
   Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected by the Owner from manufacturer's full range.
   OR
   Finish: Manufacturer's standard.
3. Glass-Fiber Mesh Fabric: ASTM D 3656, 18-by-14 or 18-by-16 **OR** 20-by-20 or 20-by-30, **as directed**, count per sq. in. (645-sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color:
   a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
4. Aluminum Wire Fabric: 18-by-16 count per sq. in. (645-sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
   a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
5. Hardware: Extruded, cast, or wrought aluminum **OR** Die-cast zinc with special coating finish **OR** Cadmium-plated steel **OR** Zinc-plated steel **OR** Nonmagnetic stainless steel, **as directed**.

a. Lock: Manufacturer's standard pull and keyless locking device on each movable panel, lockable from inside only. Adjust locking device to allow unobstructed movement of panel across adjacent panel in direction indicated.

F. Accessories
1. Grilles (False Muntins): Provide grilles in designs indicated, for removable application to inside of each panel lite.
a. Material: Extruded, rigid PVC or cellular PVC **OR** Unfinished wood **OR** Prefinished wood, **as directed**.
b. Design: Rectangular **OR** Diamond, **as directed**.
c. Construction: Full-surround grille.
d. Bar Width: Not less than 3/4 inch (19 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/8 inches (28 mm), **as directed**, wide.
e. Color: White **OR** Bronze **OR** As selected from manufacturer's full range, **as directed**.

G. Fabrication
1. Fabricate sliding wood-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring windows.
2. Fabricate sliding wood-framed glass doors that are reglazable without dismantling panel framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable panel unless otherwise indicated.
4. Factory machine sliding wood-framed glass doors for openings and hardware that is not surface applied.
5. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.
6. Factory-Glazed Fabrication: Glaze sliding wood-framed glass doors in the factory. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.
7. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames.

H. Wood Finishes
1. Factory-Primed Sliding Wood-Framed Glass Doors: Provide manufacturer's standard factory-applied prime coat complying with WDMA T.M. 11. Follow manufacturer instructions for factory-applied prime coat, if any, on exposed exterior **OR** interior **OR** exterior and interior, **as directed**, wood surfaces.
2. Factory-Finished Sliding Wood-Framed Glass Doors: Provide manufacturer's standard factory finish complying with WDMA T.M. 12, **as directed**. Apply finish to exposed exterior **OR** interior **OR** exterior and interior, **as directed**, wood surfaces.
a. Color: White **OR** Brown **OR** Gray **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination
1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
2. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
3. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding door installation.
a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

b. Wood-Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
c. Metal Surfaces: Dry and clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install sliding doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."

C. Adjusting, Cleaning, And Protection
1. Lubricate hardware and moving parts.
2. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and weathertight closure.
3. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
4. Clean frame surfaces immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
5. Clean glass immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
7. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written instructions.
8. Refinish or replace sliding doors with damaged finishes.
9. Replace damaged components.

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SECTION 08 33 16 00 - OVERHEAD COILING GRILLES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for overhead coiling grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Open-curtain overhead coiling grilles.
b. Closed-curtain overhead coiling grilles.

C. Performance Requirements
1. Delegated Design: Design overhead coiling grilles, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Overhead coiling grilles shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. Seismic Component Importance Factor: 1.5 **OR** 1.0, **as directed**.
3. Operation Cycles: Provide overhead coiling grille components and operators capable of operating for not less than number of cycles indicated for each grille. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

D. Submittals
1. Product Data: For each type and size of overhead coiling grille and accessory. Include the following:
a. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
b. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
2. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each type of exposed finish required, prepared on Samples of size indicated below.
a. Open-Curtain Grille: 18-inch- (457-mm-) square assembly with full-size components consisting of rods, spacers, and links as required to illustrate each assembly, including glazed inserts, **as directed**.
b. Closed-Curtain Grille: 18-inch- (457-mm-) square assembly with full-size components consisting of ribs and infill as required to illustrate each assembly.
c. Bottom Bar: 6 inches (150 mm) long with sensor edge, **as directed**.
d. Guides: 6 inches (150 mm) long.
e. Mounting Frame: 6 inches (150 mm) long.
f. Brackets: 6 inches (150 mm) square.
g. Hood: 6 inches (150 mm) square.

4. Delegated-Design Submittal: For overhead coiling grilles indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   a. Detail fabrication and assembly of seismic restraints.
   b. Summary of forces and loads on walls and jambs.
5. Qualification Data: For qualified Installer.
6. Seismic Qualification Certificates: For overhead coiling grilles**,** accessories, and components, from manufacturer.
7. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.
   a. Obtain operators and controls from overhead coiling grille manufacturer.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.2 PRODUCTS

A. Grille Curtain Materials And Construction
1. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
   a. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
   b. Stainless-Steel Grille Curtain: ASTM A 666, Type 300 series.
   c. Steel Grille Curtain: Hot-dip zinc-coated (galvanized) complying with ASTM A 123/A 123M, or electrogalvanized complying with ASTM 653/A 653M, and phosphatized before fabrication.
   d. Glazing Insert: Manufacturer's standard glazing of clear polycarbonate sheet secured by the curtain links.
2. Closed-Curtain Grilles: Fabricate curtain as a series of horizontal double-C ribs, spaced at regular intervals, that alternate with continuous horizontal infill panels secured by the ribs.
   a. Aluminum Horizontal Ribs: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
   b. Glass Panels: Uncoated, clear, heat-treated, fully tempered float glass; complying with ASTM C 1048, Condition A, Type I, Class I, Quality q3, Kind FT; manufacturer's standard panel dimensions and thickness.
   c. Plastic Panels: Fire-retardant polycarbonate sheet manufactured by the extrusion process; UV resistant; manufacturer's standard panel dimensions and thickness.
   d. Aluminum Panels: ASTM B 209 (ASTM B 209M), alloy and temper standard with manufacturer for type of use and finish indicated; manufacturer's standard panel dimensions and thickness; finished to match ribs.
      1) Perforations: Manufacturer's standard pinholes.
3. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.
4. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, finished to match grille.

a. Astragal: Equip each grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
b. Provide motor-operated grilles with combination bottom astragal and sensor edge.

5. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.
   a. Removable Posts and Jamb Guides: Manufacturer's standard.

B. Hoods And Accessories
1. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   a. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
   b. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
   c. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
2. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling, unless otherwise indicated.
3. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes or shapes, hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.
4. Push/Pull Handles: Equip each push-up-operated or emergency-operated grille with lifting handles on each side of grille, finished to match grille.
   a. Provide pull-down straps or pole hooks for grilles more than 84 inches (2130 mm) high.

C. Locking Devices
1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
   b. Keys: Two **OR** Three, **as directed**, for each cylinder.
3. Chain Lock Keeper: Suitable for padlock.
4. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

D. Counterbalancing Mechanism
1. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

3. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
4. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
5. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

E. Manual Grille Operators
1. Equip grille with manufacturer's recommended manual grille operator unless another type of grille operator is indicated.
2. Push-up Grille Operation: Design counterbalance mechanism so required lift or pull for grille operation does not exceed 25 lbf (111 N).
3. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force for grille operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
4. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

F. Electric Grille Operators
1. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
   a. Comply with NFPA 70.
   b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.
3. Grille Operator Location(s): Operator location indicated for each grille.
   a. Top-of-Hood Mounted: Operator is mounted to the right or left grille head plate with the operator on top of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
   b. Front-of-Hood Mounted: Operator is mounted to the right or left grille head plate with the operator on coil side of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
   c. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of grille and connected to grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
   d. Bench Mounted: Operator is mounted to the right or left grille head plate and connected to the grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
   e. Through-Wall Mounted: Operator is mounted on other side of wall from coil-side of grille.
4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements For Equipment" unless otherwise indicated.
   a. Electrical Characteristics:
      1) Phase: Single phase **OR** Polyphase, **as directed**.
      2) Volts: 115 **OR** 208 **OR** 230 **OR** 460, **as directed**, V.
      3) Hertz: 60.
   b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.

c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

5. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
6. Obstruction Detection Device: Equip motorized grille with indicated external automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
   a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.
      1) Self-Monitoring Type: Designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, grille closes only with sustained pressure on close button.
   b. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      1) Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device.
7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
   a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
   b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type; NEMA ICS 6, Type 4 enclosure, key operated.
8. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**.
9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
12. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for ADA-ABA-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive upon return of handle to original position.
13. Self-Opening Mechanism: Automatic release mechanism triggered by smoke detector, **OR** emergency push-button station, **as directed**, fire alarm or power failure. When activated, the grille self opens by means of a fail-safe operator to the fully open position without the need of power operation or battery backup systems. When the alarm is cleared **OR** emergency push-button is reset, and the alarm is cleared, **as directed**, and power is restored, the grille will operate normally.

G. Open-Curtain Grille Assembly
1. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.
2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.

a. Include tamperproof cycle counter.

3. Grille Curtain Material: Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**.
   a. Space rods at approximately 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm), **as directed**, o.c.
   b. Space links approximately 3 inches (76 mm) **OR** 6 inches (152 mm) **OR** 9 inches (228 mm), **as directed**, apart in a straight in-line **OR** brick (staggered), **as directed**, pattern.
   c. Glazing Inserts: Manufacturer's standard.
   d. Spacers: Metal tubes matching curtain material **OR** PVC, **as directed**.
4. Curtain Jamb Guides: Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**, with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings, **as directed**.
5. Hood: Match curtain material and finish **OR** Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**.
   a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
   b. Mounting: Face of wall **OR** Between jambs **OR** On mounting frame **OR** As shown on Drawings, **as directed**.
6. Locking Devices: Equip grille with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
   a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumb turn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
7. Manual Grille Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
   a. Provide operator with through-wall shaft operation.
   b. Provide operator with manufacturer's standard removable operating arm.
8. Electric Grille Operator:
   a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
   b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
   c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
   d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
   e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
      1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
   f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
   g. Other Equipment: Audible and visual signals **OR** Emergency-egress release **OR** Self-opening mechanism, **as directed**.
9. Grille Finish:
   a. Aluminum Finish: Mill **OR** Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Anodized color matching sample **OR** Anodized color as selected from full range of industry colors and color densities, **as directed**.
   b. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
   c. Factory Prime Finish: Manufacturer's standard color.
   d. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.
   e. PVC Spacers: Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

H. Closed-Curtain Grille Assembly
1. Closed-Curtain Grille: Overhead coiling grille with a curtain having a series of horizontal ribs alternating with continuous horizontal infill panels secured by the ribs.
2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
   a. Include tamperproof cycle counter.
3. Grille Curtain Material: Aluminum ribs with continuous inserts indicated.
   a. Space ribs at approximately 3 inches (76 mm), **as directed**, o.c.
   b. Inserts: Glass panels.
   c. Inserts: Clear, transparent **OR** Translucent, **as directed**, plastic panels.
   d. Inserts: Solid **OR** Perforated, **as directed**, aluminum panels.
4. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings, **as directed**.
5. Hood: Match curtain material and finish **OR** Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**.
   a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
   b. Mounting: Face of wall **OR** Between jambs **OR** On mounting frame **OR** As shown on Drawings, **as directed**.
6. Locking Devices: Equip grille with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
   a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumbturn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
7. Manual Grille Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
   a. Provide operator with through-wall shaft operation.
   b. Provide operator with manufacturer's standard removable operating arm.
8. Electric Grille Operator:
   a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
   b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
   c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
   d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
   e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
      1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
   f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
   g. Other Equipment: Audible and visual signals **OR** Emergency-egress release **OR** Self-opening mechanism, **as directed**.
9. Grille Finish:
   a. Aluminum Finish: Mill **OR** Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Anodized color matching sample **OR** Anodized color as selected from full range of industry colors and color densities, **as directed**.
   b. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
   c. Factory Prime Finish: Manufacturer's standard color.
   d. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.

I. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Aluminum Finishes
1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

K. Steel And Galvanized-Steel Finishes
1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

L. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   c. Directional Satin Finish: No. 4.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

1.3 EXECUTION

A. Examination
1. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
2. Examine locations of electrical connections.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
2. Install overhead coiling grilles, hoods, and operators at the mounting locations indicated for each grille.
3. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

C. Startup Service
1. Engage a factory-authorized service representative to perform startup service.
   a. Perform installation and startup checks according to manufacturer's written instructions.
   b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

c. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

D. Adjusting
1. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.
2. Lubricate bearings and sliding parts as recommended by manufacturer.

E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

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SECTION 08 33 23 11 - OVERHEAD COILING DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for overhead coiling doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Service doors with integral pass doors.
b. Insulated service doors with integral pass doors.
c. Counter doors.
d. Fire-rated service doors with integral pass doors.
e. Fire-rated, insulated service doors with integral pass doors.
f. Fire-rated counter doors.

C. Performance Requirements
1. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
a. Wind Loads: As indicated on Drawings **OR** Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward, **as directed**.
1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
2) Importance Factor: <**Insert factor**>.
3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
b. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
3. Operability under Wind Load: Design overhead coiling doors to remain operable under design **OR** uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), **as directed**, wind load, acting inward and outward.
4. Windborne-Debris-Impact-Resistance Performance: Provide glazed and impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.
a. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.
b. Small Missile Test: For overhead coiling doors located more than 30 feet (9.144 m) above grade.
5. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
6. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Submittals
1. Product Data: For each type and size of overhead coiling door and accessory.

2. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Show locations of replaceable fusible links.
   c. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each exposed product and for each color and texture specified.
4. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Qualification Data: For qualified Installer.
6. Seismic Qualification Certificates: For overhead coiling doors**,** accessories, and components, from manufacturer.
7. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.
8. Maintenance Data.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B, **as directed**.
   a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   c. Smoke Control: Where indicated **OR** In corridors and smoke barriers, **as directed**, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to IBC Standard 716.5 **OR** UL 1784, **as directed**; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of door opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests.
3. Sound-Control Doors: Assemblies that have been fabricated and tested to control the passage of sound and have minimum certified STC rating according to ASTM E 413.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines **OR** ICC/ANSI A117.1, **as directed**.

1.2 PRODUCTS

A. Door Curtain Materials And Construction
1. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

a. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm) and as required to meet requirements.
b. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm) and as required to meet requirements.
c. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) sheet or ASTM B 221 (ASTM B 221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm) and as required to meet requirements.
d. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection rated glass as required for type of door; set in glazing channel secured to curtain slats.
e. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
f. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
g. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 25 **OR** 75 **OR** 200, **as directed**, and smoke-developed index of 450, according to ASTM E 84.
h. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

2. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
3. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
4. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
5. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
6. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
7. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.
   a. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.
8. Pass Door(s): Door and frame assembly constructed integrally with the coiling-door assembly and bearing the same fire rating. Complying with egress and accessibility requirements of authorities having jurisdiction.
   a. Door Frame and Integral Jamb Guide: Fabricate of angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading.
   b. Hinged Frame: Hinged pass door and frame that swings out of the way, as a unit, to allow use of the full coiling-door opening width. One jamb of the pass-door frame is hinged and the other jamb includes a guide for the lower, narrower part of the coiling-door curtain.
   c. Rigid Frame: Rigid pass door and frame that are built into the rigid, lower part of the door curtain and that raise with the curtain.
   d. Locking Hardware:
      1) Lockset **OR** Exit Hardware: As specified in Division 08 Section "Door Hardware" **OR** As selected from manufacturer's full range, **as directed**.

2) Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
3) Keys: Two **OR** Three, **as directed**, for each cylinder.

e. Thresholds: Equip pass doors with integral thresholds that comply with egress and accessibility requirements of authorities having jurisdiction.

B. Hood
1. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
a. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
b. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
c. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
d. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
e. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

C. Counter Doors
1. Integral Frame, Hood, and Fascia for Counter Door: Welded sheet metal assembly of the following sheet metal:
a. Galvanized Steel: Nominal 0.064-inch- (1.63-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
b. Stainless Steel: 0.062-inch- (1.59-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
2. Integral Metal Sill for Counter Door: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4 finish.
3. Fire-Rated, Laminate Counter: Fire-door manufacturer's high-pressure decorative laminate-covered countertop, UL or ITS tested and labeled for 1-1/2-hour fire rating for approved use with fire-door assembly.

D. Locking Devices
1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
b. Keys: Provide Two **OR** Three, **as directed**, for each cylinder.
3. Chain Lock Keeper: Suitable for padlock.
4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

E. Curtain Accessories
1. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.

2. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
   a. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of hood.
   b. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.
3. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
   a. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.
4. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:
   a. Replaceable fusible links with temperature rise and melting point of 165 deg F (74 deg C) interconnected and mounted on both sides of door opening.
   b. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.
   c. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
   d. Building fire-detection and -alarm systems and manufacturer's standard door-holder-release devices.

F. Counterbalancing Mechanism
1. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
3. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
4. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
5. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

G. Manual Door Operators
1. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
2. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).
3. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
4. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

H. Electric Door Operators
1. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   a. Comply with NFPA 70.

b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
3. Door Operator Location(s): Operator location indicated for each door.
   a. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
   b. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
   c. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
   d. Bench Mounted: Operator is mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
   e. Through-Wall Mounted: Operator is mounted on other side of wall from coil side of door.
4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements For Equipment", unless otherwise indicated.
   a. Electrical Characteristics:
      1) Phase: Single phase **OR** Polyphase, **as directed**.
      2) Volts: 115 **OR** 208 **OR** 230 **OR** 460, **as directed**, V.
      3) Hertz: 60.
   b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
   c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
   d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
5. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
6. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
   a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
      1) Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
   b. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      1) Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

8. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**.
9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
12. Radio-Control System: Consisting of the following:
    a. Three-channel universal coaxial receiver to open, close, and stop door; one **OR** two, **as directed**, per operator.
    b. Multifunction remote control.
    c. Remote-antenna mounting kit.

I. Door Assembly
1. Service **OR** Insulated Service **OR** Counter, **as directed**, Door: Overhead coiling door formed with curtain of interlocking metal slats.
2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
    a. Include tamperproof cycle counter.
3. STC Rating: 26.
4. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W) **OR** 5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W), **as directed**.
5. Door Curtain Material: Galvanized steel **OR** Stainless steel **OR** Aluminum, **as directed**.
6. Door Curtain Slats: Curved **OR** Flat, **as directed**, profile slats of 1-1/4-inch (32-mm) **OR** 1-1/2-inch (38-mm) **OR** 1-7/8-inch (48-mm) **OR** 2-5/8-inch (67-mm) **OR** 3-1/4-inch (83-mm), **as directed**, center-to-center height.
    a. Perforated Slats: Approximately 1/16-inch (1.6-mm) pinholes **OR** 3/32-inch (2.4-mm) pinholes **OR** 7/8-inch- (22-mm-) wide by 3/8-inch- (10-mm-) high slots, **as directed**.
    b. Fenestrated Slats: Approximately 3- by 5/8-inch (76- by 16-mm) **OR** 4- by 5/8-inch (102- by 16-mm) **OR** 10- by 1-5/8-inch (254- by 41-mm), **as directed**, openings spaced approximately 1-1/2 inches (38 mm) apart and beginning 12 inches (305 mm) from jamb guides.
    c. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in two **OR** three, **as directed**, rows of slats at height indicated on Drawings; installed with insulated, **as directed**, vision-panel glazing.
    d. Insulated-Slat Interior Facing: Metal **OR** Plastic, **as directed**.
7. Curtain Jamb Guides: Galvanized steel **OR** Stainless steel **OR** Aluminum, **as directed**, with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings.
8. Pass Door(s): Hinged **OR** Rigid, **as directed**, frame with lockset **OR** exit hardware, **as directed**.
9. Hood: Match curtain material and finish **OR** Galvanized steel **OR** Stainless steel **OR** Aluminum, **as directed**.
    a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
    b. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
10. Integral Frame, Hood, and Fascia for Counter Door: Galvanized steel **OR** Stainless steel, **as directed**.

a. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.

11. Sill Configuration for Counter Door: No sill **OR** Integral metal sill, **as directed**.
12. Locking Devices: Equip door with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
    a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumb turn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
13. Manual Door Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
    a. Provide operator with through-wall shaft operation.
    b. Provide operator with manufacturer's standard removable operating arm.
14. Electric Door Operator:
    a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
    b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
    c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
    d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
    e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
        1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
    f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
    g. Other Equipment: Audible and visual signals **OR** Radio-control system, **as directed**.
15. Door Finish:
    a. Aluminum Finish: Mill **OR** Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Anodized color matching sample **OR** Anodized color as selected from full range of industry colors and color densities, **as directed**.
    b. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
    c. Factory Prime Finish: Manufacturer's standard color.
    d. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.
    e. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face **OR** PVC plastic, **as directed**.

J. Fire-Rated Door Assembly
1. Fire-Rated Service **OR** Insulated Service **OR** Counter, **as directed**, Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.
2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
    a. Include tamperproof cycle counter.
3. Fire Rating: 3/4 hour **OR** 1 hour **OR** 1-1/2 hours **OR** 3 hours **OR** 4 hours, **as directed**, with temperature-rise limit, **as directed**, and with smoke control, **as directed**.
4. STC Rating: 27.
5. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W) **OR** 5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W), **as directed**.
6. Door Curtain Material: Galvanized steel **OR** Stainless steel, **as directed**.
7. Door Curtain Slats: Curved **OR** Flat, **as directed**, profile slats of 1-1/4-inch (32-mm) **OR** 1-1/2-inch (38-mm) **OR** 1-7/8-inch (48-mm) **OR** 2-5/8-inch (67-mm) **OR** 3-1/4-inch (83-mm), **as directed**, center-to-center height.

a. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in two **OR** three, **as directed**, rows of slats at height indicated on Drawings; installed with fire-rated vision-panel glazing.
b. Insulated-Slat Interior Facing: Metal.

8. Curtain Jamb Guides: Galvanized steel **OR** Stainless steel, **as directed**, with exposed finish matching curtain slats.
9. Pass Door(s): Hinged **OR** Rigid, **as directed**, frame with lockset **OR** exit hardware, **as directed**.
10. Hood: Match curtain material and finish **OR** Galvanized steel **OR** Stainless steel, **as directed**.
    a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
    b. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
11. Integral Frame, Hood, and Fascia for Counter Door: Galvanized steel **OR** Stainless steel, **as directed**.
    a. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
12. Sill Configuration for Fire-Rated Counter Door: No sill **OR** Integral metal sill **OR** Fire-rated, laminate counter, **as directed**.
    a. High-Pressure Decorative Laminate: Match color, pattern, and finish as indicated by manufacturer's designations **OR** of sample **OR** as selected from manufacturer's full range, **as directed**.
13. Locking Devices: Equip door with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
    a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumbturn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
14. Manual Door Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
    a. Provide operator with through-wall shaft operation.
    b. Provide operator with manufacturer's standard removable operating arm.
15. Electric Door Operator:
    a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
    b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
    c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
    d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
    e. Obstruction Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
        1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
    f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
    g. Other Equipment: Audible and visual signals **OR** Radio-control system, **as directed**.
16. Door Finish:
    a. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
    b. Factory Prime Finish: Manufacturer's standard color.
    c. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.
    d. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

K. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

L. Aluminum Finishes
1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

M. Steel And Galvanized-Steel Finishes
1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

N. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   c. Directional Satin Finish: No. 4.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

1.3 EXECUTION

A. Installation
1. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
2. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
3. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
4. Fire-Rated Doors: Install according to NFPA 80.
5. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

B. Startup Service
1. Engage a factory-authorized service representative to perform startup service.
   a. Perform installation and startup checks according to manufacturer's written instructions.
   b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   c. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

C. Adjusting
1. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

2. Lubricate bearings and sliding parts as recommended by manufacturer.
3. Adjust seals to provide weathertight fit around entire perimeter.

END OF SECTION 08 33 23 11

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Task	Specification	Specification Description
08 33 23 11	08 33 16 00	Overhead Coiling Grilles
08 33 23 13	01 22 16 00	No Specification Required
08 33 26 00	08 33 16 00	Overhead Coiling Grilles

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SECTION 08 33 36 00 - SIDE COILING GRILLES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for side coiling grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements
1. Operation-Cycle Requirements: Provide side coiling grille components and operators capable of operating for not less than 10,000 **OR** 20,000, **as directed**, cycles and for 10 cycles per day.

C. Submittals
1. Product Data: For each type and size of side coiling grille and accessory.
2. Shop Drawings: Include plans, elevations, sections, details, and attachment to other work.
3. Samples: For each exposed finish.

D. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

1.2 PRODUCTS

A. Grille Curtain Materials And Construction
1. Grille Curtain: Network of 1/4-inch- (6-mm-) **OR** 5/16-inch- (8-mm-), **as directed**, minimum diameter horizontal rods, or rods covered with tube spacers. Interconnect rods by vertical links approximately 5/8 inch (16 mm) wide and rotating on rods.
   a. Space rods at approximately 1-1/2 inches (38 mm) o.c.
   b. Space links approximately 3 inches (76 mm) apart in a straight in-line **OR** staggered, **as directed**, pattern.
   c. Steel Grille Curtain: Hot-dip zinc-coated (galvanized), complying with ASTM A 123/A 123M, or electrogalvanized complying with ASTM 653/A 653M, and phosphatized before fabrication.
   d. Stainless-Steel Grille Curtain: ASTM A 666, Type 300 series.
   e. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
2. Top Track: Extruded aluminum channel mechanically attached to a support angle with provisions for take-up bolts to compensate for a maximum deflection of 1/2-inch.
3. Bottom Track: Manufacturer's standard, finished to match grille.
4. Coil Box: Entirely enclose coiled grille, operating mechanism, supporting disk and the drum around which the grille will coil.
5. Power Operated Grille: Safety interlock switch to disengage power supply when grille is locked.
6. Manual Grille Operator: Crank or Push-Pull.
7. Electric Grille Operator: Manufacturer's standard type, size, and capacity for grille and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories. Comply with NFPA 70.
   a. Disconnect Device: Hand-operated for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor,

without affecting timing of limit switch. Mount to be accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

b. Grille-Operator Type: Wall- or bracket-mounted unit with electric motor, gear-reduction drive, and chain and sprocket secondary drive**.**

8. Electric Motors: High-starting torque, reversible, continuous-duty, polyphase, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate grille in either direction from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or service factor. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
   a. Open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
   b. Totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.
9. Remote-Control Station: Momentary-contact **OR** Sustained-pressure, **as directed**, three-button control station; fully guarded, weatherproof (if for exterior location), key operated.
10. Obstruction Detection Device: External automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses grille travel.
11. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

B. Finishes
1. Aluminum Anodic Finish: Mill finish **OR** Class II, clear anodic coating complying with AAMA 611, **as directed**.
2. Galvanized Steel Finish: Manufacturer's standard primer **OR** Powder-coat finish, **as directed**.
   a. Color and Gloss: As selected from manufacturer's full range.
   b. Painting is specified in Division 09 Section(s) "Interior Painting" OR "Staining And Transparent Finishing".
3. Stainless-Steel Finish: Bright, cold-rolled, unpolished finish: No. 2B finish **OR** Bright, directional polish: No. 4 finish, **as directed**.

1.3 EXECUTION

A. Installation
1. General: Install side coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports.
2. Lubricate bearings and sliding parts; adjust grilles to operate easily, free of warp, twist, or distortion.

END OF SECTION 08 33 36 00

Task	Specification	Specification Description
08 34 13 00	01 22 16 00	No Specification Required
08 34 16 00	01 22 16 00	No Specification Required
08 34 23 00	08 31 13 00	Access Doors And Frames

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SECTION 08 34 53 00 - DETENTION DOORS AND FRAMES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for detention doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Swinging detention doors.
b. Sliding detention doors.
c. Detention panels.
d. Detention frames.

C. Definitions
1. Minimum-Thickness Steel: Indicated as the specified minimum thicknesses for base metal without coatings, according to HMMA 803.
2. Nominal-Thickness Stainless Steel: Indicated as the specified thicknesses for which over- and under-thickness tolerances apply, according to ASTM A 480/A 480M.
3. Nominal Surface of Floor Covering: Top surface of floor; for resilient tile and carpet, nominal surface of floor covering is defined as top of concrete slab.

D. Performance Requirements
1. Detention Doors and Frame Assemblies: Provide detention doors and frames that comply with the following, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project:
a. Security Grade: Comply with Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, according to ASTM F 1450.
b. Bullet Resistance: Comply with Level 3 rating when tested according to UL 752.
1) Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, as bullet resisting.
c. Tool-Attack Resistance: Comply with small-tool-attack-resistance rating when tested according to UL 437 and UL 1034.
2. Detention Frames: Provide sidelight and borrowed-light detention frames that comply with ASTM F 1592 and removable stop test according to HMMA 863, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

E. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and temperature-rise ratings, and finishes for each type of detention doors and frames specified.
2. Shop Drawings: In addition to requirements below, provide a schedule using same reference numbers for details and openings as those on Drawings:
a. Elevations of each door design.
b. Direction of swing **OR** slide, **as directed**.
c. Inmate and non-inmate sides.
d. Details of doors, including vertical and horizontal edge details, and metal thicknesses.
e. Details of frames, including dimensioned profiles, and metal thicknesses.
f. Locations of reinforcement and preparations for hardware.
g. Details of each different wall opening condition.
h. Details of anchorages, joints, field splices, and connections.

i. Details of food-pass openings, louvers, speaking apertures, and gun ports.
j. Details of moldings, removable stops, and glazing.
k. Details of conduit, junction boxes, and preparations for electrified and pneumatic door hardware.

3. Samples:
   a. For each type of exposed finish required.
   b. For the following items to demonstrate compliance with requirements for quality of materials and construction:
      1) Detention Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
      2) Detention Frames: Show profile, welded corner joint, welded hinge reinforcement, grout-cover boxes, floor and wall anchors, and silencers. Include separate section showing fixed steel panels and glazing if applicable.
4. Coordination Drawings: Drawings of each detention door and frame, drawn to scale, on which connections and interface with electrified and pneumatic control systems are shown.
5. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
6. Welding certificates.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for detention doors and frames. Indicate metal thickness of each component of tested assembly and describe construction methods.
8. Field quality-control reports documenting inspections of installed products.

F. Quality Assurance
1. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   b. AWS D1.3, "Structural Welding Code - Sheet Steel."
   c. AWS D1.6, "Structural Welding Code - Stainless Steel."
2. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B **OR** UL 10C, **as directed**.
   a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Fire-Rated Detention Sidelight and Borrow-Light Frames: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
4. Smoke-Control Detention Door Assemblies: Comply with NFPA 105.

G. Delivery, Storage, And Handling
1. Deliver detention doors and frames palleted, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
2. Deliver detention frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
3. Inspect units, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Architect; otherwise, remove and replace damaged items as directed.

4. Store detention doors and frames under cover at building site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
   a. Provide minimum 1/4-inch (6-mm) space between each stacked unit to permit air circulation.

H. Maintenance Tools
1. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.

1.2 PRODUCTS

A. Materials
1. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
4. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304.
5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
6. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
7. Masonry Anchors: Fabricated from same steel sheet as door face.
8. Embedded Anchors: Fabricated from mild steel shapes and plates, hot-dip galvanized according to ASTM A 153/A 153M.
9. Postinstalled Expansion Anchors: With capability to sustain, without failure, a load equal to 4 times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition (mild).
   b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 276 or ASTM A 666, Type 304 or 316, for anchors.
   c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
10. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
11. Glazing: Comply with Division 08 Section "Security Glazing".
12. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.
13. Insulation: Slag-wool-fiber/rock-wool-fiber or glass-fiber blanket insulation. ASTM C 665, Type I (unfaced); with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Minimum 1.5-lb/cu. ft. (24-kg/cu. m) density.
14. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

B. Detention Doors
1. General: Provide flush-design detention doors of seamless hollow construction, 2 inches (51 mm) thick unless otherwise indicated. Construct detention doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
   a. For single-acting swinging detention doors, bevel both vertical edges 1/8 inch in 2 inches (3 mm in 51 mm).
   b. For sliding detention doors, square both vertical edges.
2. Core Construction: Provide the following core construction of same material as detention door face sheets, welded to both detention door faces:

a. Steel-Stiffened Core: 0.042-inch- (1.0-mm-) thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 4 inches (102 mm) apart, spot welded to face sheets a maximum of 3 inches (76 mm) o.c. Fill spaces between stiffeners with insulation.
b. Truss-Stiffened Core: 0.013-inch- (0.3-mm-) thick, steel, truncated triangular stiffeners extending between face sheets and for full height and width of door; with stiffeners welded to face sheets not more than 3 inches (76 mm) o.c. vertically and 2-3/4 inches (70 mm) horizontally. Fill spaces between stiffeners with insulation.

3. Vertical Edge Channels: 0.123-inch- (3.1-mm-) thick, continuous channel of same material as detention door face sheets, extending full-door height at each vertical edge; welded to top and bottom channels to create a fully welded perimeter channel. Noncontiguous channel is permitted to accommodate lock-edge hardware only if lock reinforcement is welded to and made integral with channel.
4. Top and Bottom Channels: 0.123-inch- (3.1-mm-) thick metal channel of same material as detention door face sheets, spot welded, not more than 4 inches (102 mm) o.c., to face sheets.
   a. Reinforce top edge of detention door with 0.053-inch- (1.3-mm-) thick closing channel, inverted and nesting in top channel; welded so channel web is flush with top door edges.
5. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention door face sheets to comply with the following minimum thicknesses:
   a. Full-Mortise Hinges and Pivots: 0.187 inch (4.7 mm) thick.
   b. Maximum-Security Surface Hinges: 0.250 inch (6.3 mm) thick.
   c. Strike Reinforcements: 0.187 inch (4.7 mm) thick.
   d. Slide-Device Hanger Attachments: As recommended by device manufacturer.
   e. Lock Fronts, Concealed Holders, and Surface-Mounted Closers: 0.093 inch (2.3 mm) thick.
   f. All Other Surface-Mounted Hardware: 0.093 inch (2.3 mm) thick.
   g. Lock Pockets: 0.123 inch (3.1 mm) thick at non-inmate side, welded to face sheet.
6. Hardware Enclosures: Provide enclosures and junction boxes for electrically operated detention door hardware of same material as detention door face sheets, interconnected with UL-approved, 1/2-inch- (13-mm-) diameter conduit and connectors.
   a. Where indicated for installation of wiring, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least 4 security fasteners spaced not more than 6 inches (152 mm) o.c.
7. Interior Detention Door Face Sheets: Fabricated from cold-rolled steel sheets **OR** metallic-coated steel sheets **OR** stainless-steel sheets, **as directed**.
   a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
   d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
8. Exterior Detention Door Face Sheets: Fabricated from metallic-coated steel sheets **OR** stainless-steel sheets, **as directed**.
   a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
   d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.

C. Detention Panels

1. Provide fixed detention panels of same materials, construction, and finish as specified for adjoining detention frame.

D. Detention Frames
1. General: Provide fully welded detention frames with integral stops, of seamless construction without visible joints or seams. Fabricate detention frames with contact edges closed tight and corners mitered, reinforced, and continuously welded full depth and width of detention frame.
2. Provide two temporary steel spreaders spot welded to bottom of jambs to act as bracing during shipping and storage. Remove prior to installation.
3. Stop Height: Provide minimum stop height of 0.625 inch (16 mm) **OR** 0.750 inch (19 mm), **as directed,** for detention door openings and minimum stop height of 1-1/4 inches (32 mm) in security glazing or detention panel openings unless otherwise indicated.
4. Interior Detention Frames: Fabricated from cold-rolled steel sheets **OR** metallic-coated steel sheets where indicated **OR** stainless-steel sheets for stainless-steel detention doors, **as directed**.
   a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
   d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
5. Exterior Detention Frames: Fabricated from metallic-coated steel sheets **OR** stainless-steel sheets for stainless-steel detention doors, **as directed**.
   a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
   c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
   d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
6. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention frame to comply with the following minimum thicknesses:
   a. Hinges and Pivots: 0.187 inch (4.7 mm) thick by 1-1/2 inches (38 mm) wide by 10 inches (254 mm) long.
   b. Strikes, Flush Bolts, and Closers: 0.187 inch (4.7 mm) thick.
   c. Surface-Mounted Hardware: 0.093 inch (2.3 mm) thick.
   d. Lock Pockets: 0.123 inch (3.1 mm) thick at non-inmate side, welded to face sheet. Provide 0.123-inch- (3.1-mm-) thick, lock protection plate for attachment to lock pocket with security fasteners.
7. Hardware Enclosures: Provide enclosures and junction boxes for electrically operated detention door hardware, interconnected with UL-approved, 1/2-inch- (13-mm-) diameter conduit and connectors.
   a. Where indicated for installation of wiring, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least 4 security fasteners spaced not more than 6 inches (152 mm) o.c.
8. Mullions and Transom Bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between detention frame members with concealed clip angles or sleeves of same metal and thickness as detention frame.
9. Jamb Anchors: Weld jamb anchors to detention frames near hinges and directly opposite on strike jamb or as required to secure detention frames to adjacent construction.
   a. Number of Anchors: Provide two anchors per jamb plus the following:
      1) Detention Door Frames: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 54 inches (1372 mm) in height.

2) Detention Frames with Security Glazing or Detention Panels: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 36 inches (914 mm) in height.

b. Masonry Anchors: Adjustable, corrugated or perforated, strap-and-stirrup anchors to suit detention frame size; formed of same material and thickness as detention frame; with strap not less than 2 inches (51 mm) wide by 10 inches (254 mm) long.

c. Embedded Anchors: Provide detention frames with removable faces at jambs where embedded anchors are indicated. Anchors consist of three parts:

1) Embedded Plates: Steel plates, 0.188 inch thick by 4 inches wide by 6 inches (4.7 mm thick by 102 mm wide by 152 mm) long. Continuously weld 2 steel bars, 1/2 inch (13 mm) in diameter and 10 inches (254 mm) long with 2-inch (51-mm) 90-degree turndown on ends, to the embedded end of each plate. Weld steel angles, 0.188 inch thick by 2 by 2 by 4 inches (4.7 mm thick by 51 by 51 by 102 mm) long, to the exposed end of each plate. Embed at locations to match frame angles.

2) Frame Angles: Steel angles, 0.188 inch thick by 2 by 2 by 4 inches (4.7 mm thick by 51 by 51 by 102 mm) long, welded to detention frames with 1-inch- (25-mm-) long welds at each end of angle.

3) Connector Angles: Steel angles, of size required, to connect frame angles and embedded plates.

d. Postinstalled Expansion Anchors: Minimum 1/2-inch- (13-mm-) diameter concealed bolts with expansion shields or inserts. Provide conduit spacer from detention frame to wall, welded to detention frame. Reinforce detention frames at anchor locations.

10. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material and thickness as detention frame, and as follows:

a. Monolithic Concrete Slabs: Clip anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions with at least four spot welds per anchor.

b. Separate Topping Concrete Slabs: Adjustable anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment, welded to jambs and mullions with at least 4 spot welds per anchor. Terminate bottom of detention frames at finish floor surface.

11. Rubber Door Silencers: Except on weather-stripped detention doors, drill stops in strike jambs to receive three silencers on single-detention-door frames and drill head jamb stop to receive two silencers on double-detention-door frames. Keep holes clear during construction.

12. Grout Guards: Provide factory-installed grout guards of same material as detention frame, welded to detention frame at back of hardware cutouts, silencers, and glazing-stop screw preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.

E. Moldings And Stops

1. Provide fixed moldings on inmate side of glazed openings and removable stops on non-inmate side.

a. Height: As required to provide minimum 1-inch (25-mm) glass engagement, but not less than 1-1/4 inches (32 mm).

b. Fixed Moldings: Formed from same material as detention door and frame face sheets, but not less than 0.093-inch- (2.3-mm-) thick, spot welded to face sheets a maximum of 5 inches (127 mm) o.c.

c. Removable Stops: Formed from 0.123-inch- (3.1-mm-) thick angle, of same material as detention door face sheets. Secure with button head security fasteners spaced uniformly not more than 9 inches (229 mm) **OR** 6 inches (152 mm), **as directed,** o.c. and not more than 2 inches (51 mm) from each corner, and as necessary to satisfy performance requirements. Form corners with notched or mitered hairline joints.

2. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

F. Accessories

1. Pass-Through Openings: Fabricate flush openings using 0.093-inch- (2.3-mm-) thick interior channels of same material as detention door faces, inverted to be flush with openings, welded to inside of both face sheets and with corners fully welded. Mount shutters on non-inmate side of detention doors. Reinforce for locks and food-pass hinges.
   a. Inset Shutters: Fabricate from 2 steel plates, 0.123 inch (3.1 mm) thick, of same material as detention door face sheets, spot welded together and sized to inset inside opening and to prevent inmate tampering of lock and hinges.
   b. Overlapping Shutters: For surface application on non-inmate side of door. Fabricate from a single steel plate, of same material as detention door face sheets, 0.187 inch (4.7 mm) thick, sized to overlap food-pass openings 1/2 inch (13 mm).
2. Detention Door Louvers: Fabricate flush louver openings using 0.093-inch- (2.3-mm-) thick, interior steel channels of same material as detention door faces, welded to inside of both detention door face sheets and with corners fully welded. Provide welded, inverted V- or Y-shaped vanes allowing specified airflow, fabricated from same material as detention door face sheets, 0.093 inch (2.3 mm) thick, and spaced so no rigid flat instrument can pass through.
   a. Reinforcement: Reinforce louvers that exceed 18 inches (457 mm) in height at louver midpoint with 1/4-by-1-1/2-inch- (6.3-by-38-mm-) square, vertical rectangular steel bar or 3/4-inch- (19-mm-) diameter, vertical steel bar.
   b. Airflow: Airflow and static-pressure loss **as directed**.
   c. Exterior Detention Door Insect Screens: Fabricated from 12-by-12 (2.1-by-2.1-mm) mesh of 0.028-inch- (0.71-mm-) diameter, stainless-steel wire or from perforated metal of same material and thickness as detention door face sheet with 1/8-inch- (3-mm-) diameter holes spaced 1 inch (25 mm) o.c.; where indicated.
3. Speaking Apertures: Consisting of a rectangular pattern of holes, minimum 1 inch high by 4 inches wide (25 mm high by 102 mm wide), with holes 1/4 inch (6 mm) in diameter. Locate holes in both face sheets directly across from each other and spaced not more than 1 inch (25 mm) o.c. vertically and horizontally. Provide 0.067-inch- (1.7-mm-) thick, pressed-steel baffles in interior of detention door between hole patterns to prevent passage of objects.
4. Gun Ports: Fabricate units to comply with UL 752 and to resist same security level as detention doors in which they are installed.

G. Security Fasteners
1. Security Fasteners: Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator.
2. Drive-System Type, Head Style, Material, and Protective Coating: Provide as required for assembly, installation, and strength, and as follows:
   a. Drive-System Types: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
   b. Fastener Strength: Grade 8 (Class 10.9).
   c. Socket Button Head Fasteners:
      1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
      2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
   d. Socket Flat Countersunk Head Fasteners:
      1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
      2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
   e. Socket Head Cap Fasteners:
      1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
      2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
   f. Protective Coatings for Heat-Treated Alloy Steel:
      1) Zinc and clear trivalent chromium, for exterior applications and interior applications where indicated.
      2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

H. Fabrication
1. Fabricate detention doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of

metal. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

2. Tolerances: Fabricate detention doors and frames to comply with manufacturing tolerances indicated in HMMA 863.
3. Fabricate multiple-opening detention frames with mullions that have closed tubular shapes and with no visible seams or joints.
4. Exterior Detention Doors: Provide weep-hole openings in bottom of detention doors to permit entrapped moisture to escape. Seal joints in top edges of detention doors against water penetration.
5. Hardware Preparation: Factory prepare detention doors and frames to receive mortised hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final door hardware schedule and templates provided by detention door hardware supplier.
   a. Reinforce detention doors and frames to receive surface-mounted door hardware. Drilling and tapping may be done at Project site.
   b. Locate door hardware as indicated or, if not indicated, according to HMMA 831.
6. Factory cut openings in detention doors.
7. Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

I. General Finish Requirements
   1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   2. Finish detention doors and frames after assembly.

J. Metallic-Coated Steel Sheet Finishes
   1. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SPPC-Paint 20, to comply with ASTM A 780.
   2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.02 mm).
      a. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for zinc-coated steel; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

K. Steel Sheet Finishes
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.02 mm).
      a. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with ANSI A250.10 acceptance criteria; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

L. Stainless-Steel Finishes
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   c. Directional Satin Finish: No. 4.

1.3 EXECUTION

A. Preparation
1. Remove welded-in shipping spreaders installed at factory.
2. Prior to installation and with shipping spreaders removed, adjust detention frames for squareness, alignment, twist, and plumbness to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb and perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of face.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of door rabbet.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

B. Installation
1. General: Install detention doors and frames plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings, schedules, and manufacturer's written recommendations.
2. Anchorage: Set detention frame anchorage devices according to details on Shop Drawings and per anchorage device manufacturer's written instructions.
   a. Masonry Anchors: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   b. Embedded Anchors: Install embedded plates in wall surrounding frame openings to match frame angle locations.
   c. Postinstalled Expansion Anchors: Drill holes in existing construction at locations to match bolt locations and install bolt expansion shields or inserts.
3. Assemble detention frames fabricated in sections. Install angle splices at each corner, of same material and thickness as detention frame, and extend at least 4 inches (102 mm) on both sides of joint.
   a. Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
   b. Continuously weld and finish smooth joints between faces of abutted, multiple-opening, detention frame members.
   c. Field Welding: Comply with the following requirements:
      1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      2) Obtain fusion without undercut or overlap.
      3) Remove welding flux immediately.
      4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
4. Apply bituminous coating to backs of frames prior to filling with grout.
5. Placing Detention Frames: Install detention frames of sizes and profiles indicated. Set detention frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   a. Embedded Anchors: Remove jamb faces from detention frames and set detention frames into opening. Weld steel connector angle to frame angle and to embedded plate with 1-

inch- (25-mm-) long welds at each end of connector angle to form a rigid frame assembly solidly anchored. Reinstall jamb faces using security fasteners.

b. Postinstalled Expansion Anchors: Install bolt. After bolt is tightened, weld bolt head to provide nonremovable condition. Grind, dress, and finish smooth welded bolt head.

c. At fire-rated openings, install detention frames according to NFPA 80.

d. Install detention frames with removable stops located on non-inmate side of opening.

6. Grout: Fully grout detention frame jambs and heads. Completely fill space between frames and adjacent substrates. Hand trowel grout and take other precautions, including bracing detention frames, to ensure that frames are not deformed or damaged by grout forces.

7. Swinging Detention Doors: Fit non-fire-rated detention doors accurately in their frames, with the following clearances:

a. Between Doors and Frames at Jambs and Head: 1/8 inch (3.2 mm).

b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm).

c. At Door Sills with Threshold: 3/8 inch (9.5 mm).

d. At Door Sills without Threshold: 3/4 inch (19.1 mm).

e. Between Door Bottom and Nominal Surface of Floor Covering: 1/2 inch (12.7 mm).

8. Sliding Detention Doors: Fit sliding detention doors in their frames according to manufacturer's written instructions and as required to allow doors to slide without binding.

9. Fire-Rated Detention Doors: Install with clearances as specified in NFPA 80.

10. Smoke-Control Detention Doors: Install according to NFPA 105.

11. Installation Tolerances: Comply with installation tolerances indicated in HMMA 863.

12. Glazing: Comply with installation requirements in Division 08 Section "Security Glazing", unless otherwise indicated.

C. Field Quality Control

1. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

2. Remove and replace detention work where inspections indicate that work does not comply with specified requirements.

3. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.

4. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

5. Select one detention door at random from detention doors delivered to Project and have it cut in half or otherwise taken apart for verification that construction complies with requirements.

6. Test Method: Verify weld strength by prying or chiseling door apart at edge seams, end channels, or stiffeners. Not more than five percent of welds may fail test.

a. If tested door fails, replace or rework all detention doors to bring them into compliance at Contractor's expense.

b. If tested door passes, replace tested door at Contractor's expense.

D. Adjusting And Cleaning

1. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including detention doors and frames that are warped, bowed, or otherwise unacceptable.

2. Clean grout and other bonding material off detention doors and frames immediately after installation.

3. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

a. After finishing smooth field welds, apply air-drying primer.

4. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

5. Stainless-Steel Surfaces: Clean surfaces according to manufacturer's written instructions.

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SECTION 08 34 53 00a - SECURITY GRILLES

DESCRIPTION OF WORK

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

GENERAL

System Description

1. Performance Requirements: Comply with following:
   a. Performance Tests: Conducted by accredited independent testing laboratory in accordance with specified requirements in this Section.
      1) Source Quality Control Performance Tests: Conducted in shop or laboratory by accredited independent laboratory.
      2) Field Quality Performance Tests: Conducted in field.
   b. Test Grilles: Completely assembled grille, including hardware, mounted vertically in accordance with manufacturer's recommendations.
      1) Test Grille Size: 914 mm (36 inches) wide by 1 219 mm (48 inches) high.
2. Bar Type Security Grilles:
   a. Impact Test: Test Grille: Withstand impact force of 111 N (25 foot-pounds) with no breaking of welds or bar separation exceeding 127 mm (5 inches).
   b. Bar Separation Test: Test Grille: Withstand bar separation test force of 227 kg (500 pounds) with no breaking of welds or bar separation exceeding 127 mm (5 inches).
   c. Sag Test: If grille is equipped with side (jamb) hinges, Test Grille in Fully Extended Position: Withstand sag load of 34 kg (75 pounds) with permanent set after load removal not exceeding 1.6 mm (0.063 inch).
   d. Forced Entry Resistance Test: If grille is equipped with side (jamb) hinges, test in closed position. Grille shall withstand forced entry loads and shall not be rendered openable throughout test.
3. Window Type Security Grilles:
   a. Operating Force: Operating Panels: Operate with force exceeding 16 kg (35 pounds) after panel is in motion.
   b. Impact Test: Test Grille: Withstand impact force of 111 N (25 foot-pounds). Sheet of double strength glass placed 76 mm (3 inches) behind grille material shall remain uncracked or unbroken after impact. No damage occurs that would allow entry through grille.
   c. Forced Entry Resistance Test: If grille is operable, test grille in closed position. Grille shall withstand forced entry loads and shall not be rendered openable throughout test.
4. Child Guard Security Grilles:
   a. Impact Test: Test Grille: Withstand impact force of 67 N (15 foot- pounds) with no weld or fastener breakage or bar separation exceeding 127 mm (5 inches).
   b. Bar Separation Test: Withstand bar separation test force of 23 kg (50 pounds) with no weld or fastener breakage or bar separation exceeding 127 mm (5 inches).
5. Security Guard Security Grilles:
   a. Impact Test: Test Grille in Fully Extended Position: Withstand impact force of 111 N (25 foot-pounds) with no weld or fastener breakage or bar separation exceeding 127 mm (5 inches).
   b. Bar Separation Test: Withstand bar separation test force of 23 kg (50 pounds) with no breaking of welds or bar separation exceeding 127 mm (5 inches).

c. Sag Test: If grille is operable and equipped with side (jamb) hinges, test grille in fully extended position. Grille shall withstand sag load of 34 kg (75 pounds) with permanent set after load removal not exceeding 1.6 mm (0.063 inch).
d. Forced Entry Resistance Test: If grille is operable, test grille in closed position. Grille shall withstand forced entry loads and shall not be rendered openable throughout test.

Submittals

6. Product Data:
7. Shop Drawings:
   a. Include standard details showing recommendations for installation.
   b. Include size of fasteners, maximum spacing from each end, center-to-center spacing on all four sides, minimum penetration of fasteners into load-bearing material and maximum clearance between frame and rough opening.
8. Samples: Submit full set of finish color samples for color selection.
9. Quality Assurance/Control Submittals:
   a. Test Reports: Results of testing by accredited independent laboratory demonstrating compliance of security grilles with specified performance requirements.
   b. Certificates: Manufacturer's written certification that security grilles meet or exceed specified performance requirements.
10. Closeout Submittals:
    a. Special warranty.

Quality Assurance

11. Certifications: Comply with ANSI Z34.2.
12. Regulatory Requirements:
    a. Egress Requirements and Fireman Access: Comply with applicable codes and regulations.
       1) Accessibility: Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
          a) Uniform Federal Accessibility Standards (UFAS).
       2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
       3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
       4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
13. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of security grille with specified finish for acceptance.
    a. Locations: As directed.
    b. Approved Mock-ups: Standard for rest of work.
    c. Approved Mock-ups: May remain part of completed project.

Delivery, Storage, And Handling

14. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to pevent damage during shipping.
15. Acceptance at Site: Inspect security grilles upon delivery. Replace damaged or defective materials before installation.
16. Storage and Protection: Store security grilles in manner to protect from weather and other damage.

Project Conditions

17. Field Measurements: Field measure openings for security grilles before start of fabrication.

Scheduling And Sequencing

18. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

19. Special Warranty: Provide one year written covering materials and installation for security grilles.

a. Warranty: Include coverage of hardware.
b. Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement security grille.

PRODUCTS

Security Grilles: KANE Screens, or approved equivalent.

20. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors and equipment.
    a. Egress Requirements and Fireman Access: Comply with applicable codes and regulations.
21. Materials:
    a. Aluminum: ASTM B 221 commercial quality and of proper alloy for grille construction, free from defects impairing strength and/or durability.
        1) Zinc Limit: 3.0 percent in order to assure that cladding is anodic to core.
        2) Aluminum Extrusions: Minimum ultimate tensile strength of 151 600 kPa (22,000 PSI) and maximum yield strength of 110 300 kPa (16,000 PSI).
    b. Steel :
        1) Shapes, Plates and Bars: ASTM A 36 or ASTM A 569.
        2) Steel Pipe: ASTM A 53.

Accessories

22. Hardware: Designed to perform functions for which it is intended and securely attached to grille.
    a. Operable Grilles: Equipped with locks capable of meeting specified forced-entry requirements.
    b. Locks: Releasable from interior but properly guarded to prevent access from exterior when window is open.
23. Anchoring Devices Used in Erection of Grilles: Nonmagnetic stainless steel or other noncorrosive material compatible with grille.
    a. Anchors Exposed when Grille is Closed and Locked: Non-removable security type.
24. Fasteners:
    a. Screws, Nuts, Washers, Bolts, Rivets, and Other Miscellaneous Fastening Devices Incorporated in Grilles: Nonmagnetic stainless steel or other corrosion resistant materials compatible with security grille and of sufficient strength to perform functions for which they are used.
    b. Fasteners Concealed when Grille is installed and Closed: Magnetic stainless steel having chromium content of not less than 16 percent.
    c. Fasteners Concealed when Grille is installed and Open: ASTM B 766 cadmium plated steel, ASTM B 633 zinc plated steel, or ASTM B 456 nickel or chrome plated steel.

Fabrication

25. Security Grilles: Fabricated of aluminum or steel and assembled in secure and workmanlike manner to perform as specified and to assure neat construction.
    a. Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
    b. Grilles: Constructed to reject passage of 102 mm (4 inch) diameter sphere at every space and interval when installed.
    c. Grille Swing Width for Side Mounting: Maximum of 900 mm (3 feet). For opening in excess of 900 mm (3 feet), provide combination of fixed and operable grilles.
    d. Grilles: Meet or exceed specified performance requirements in this Section.
    e. Grilles: Comply with applicable fire codes.
26. Bar Type Security Grilles: Constructed of rigid aluminum or steel bars and of construction to meet or exceed specified performance requirements in this Section.
    a. Fixed and Operable Bar Type Security Grilles: May be jamb or side hinged for egress.
27. Window Type Security Grilles: Constructed of aluminum or steel frame with two movable vent frames.

a. Vent Frames: Glazed with vinyl coated expanded carbon steel, No. 9 - 38 mm (1-1/2 inch) diamond pattern or equal.
b. Grilles: Constructed in manner to meet or exceed specified performance requirements in this Section.

28. Child Guard Security Grilles: Constructed of aluminum or steel bar or tubes and constructed to adjust and mount to exterior track of existing double or single hung windows.
    a. Grilles: Constructed in manner to meet or exceed specified performance requirements in this Section.
29. Security Guard Security Grilles: Constructed of aluminum or steel bars or tubes and constructed to adjust and mount to exterior of existing double or single hung window.
    a. Fixed and Operable Window Guard Security Grilles: May be jamb or side hinged, or top hinged, for egress.
    b. Grilles: Constructed in manner to meet or exceed specified performance requirements in this Section.

Finishes

30. Grilles: Factory applied baked on enamel painted finish.
    a. Exposed Surfaces: Clean and free from serious surface blemishes.
    b. Dress and finish exposed welded joints.
    c. Steel: Rust resistive primer under baked on enamel.
    d. Color: As selected from manufacturer's standard colors.

Source Quality Control

31. Testing: Performed by accredited independent testing laboratory. Use following HUD test procedures to determine if security grilles comply with specified performance requirements in this Section:
32. Sag Test for Side Mounted Grilles: Mount test grille into rigid frame to prevent movement of grille frame during loading.
    a. Fully Assembled Grille: Opened to 90 degrees or to its open stop.
    b. Test Load: Applied vertically at point 760mm (30 inches) from face of frame on operating portion of grille.
    c. Load: Maintained for period of 3 minutes.
    d. After removal of load, measure permanent sag at point of load application.
33. Impact Test: Mount test grille into rigid frame per manufacturer's recommendations.
    a. One Impact: Made at center of grille or point deemed most susceptible to impact by testing agency.
    b. Application of Impact Load: Made using 275 mm (11 inch) diameter sphere on free-swinging pendulum.
    c. Impact: Made at bottom of pendulum arc.
    d. Impact for Window Type Grille: Made at center of interior sash.
34. Bar Separation Test: Subject test grille to separation test at its weakest point of resistance.
    a. Separation Load: Applied by means of pneumatic or hydraulic cylinder with adequate controls to apply load slowly to avoid quick impact.
    b. Load: Maintained for period of 10 seconds before release.
35. Forced Entry Resistance Test: Mount test grille into rigid frame to prevent movement of grille during test.
    a. Test Loads: Applied at point within 150 mm (6 inches) of locking mechanism in direction tending to open grille.
    b. Load A of 34 kg (75 pounds) and Load B of 68 kg (150 pounds): Applied simultaneously, held for 10 seconds and released.
    c. Load A of 34 kg (75 pounds): Applied vertically upward.
    d. Load B of 68 kg (150 pounds): Applied perpendicular to face of grille in opening direction.
    e. Load C of 34 kg (75 pounds): Applied horizontally from load point toward jamb opposite load.

EXECUTION

Examination

36. Site Verification of Conditions:
    a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
    b. Existing Conditions: Examine openings before beginning installation.
    c. Do not proceed with installation until conditions are satisfactory.

Preparation

37. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
    a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
    b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
38. Existing Security Grilles: Remove existing grilles and debris from site in accordance with Detailed Scope of Work.
39. Preparation: Prepare openings and existing frames as required to comply with Performance Requirements.

Installation

40. General: Install in accordance with manufacturer's recommendations, Reference Standards, and approved Shop Drawings to comply with Performance Requirements.
    a. Security Grilles: Securely anchor in place to straight, plumb and level condition, without distortion.
    b. Egress Requirements and Fireman Access: Comply with applicable codes and regulations.
41. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
    a. Separate dissimilar metals with bituminous paint, suitable sealant, non-absorptive plastic or elastomeric tape, or gasket between surfaces.
        1) Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Field Quality Control

42. Field Testing: Contractor shall have field testing of installed security grilles conducted by a testing agency in accordance with performance test described under Performance Requirements in this Section and Source Quality Control in this Section. Tests will be modified as required for field conditions.
    a. Contractor: Provide incidental labor facilities necessary to facilitate inspections and tests.
    b. Costs of Testing:
        1) By Contractor: Initial tests with failures and subsequent tests as required because of test failures. Costs shall include costs of Architect/Engineer and other consultants for observations of tests and corrective work.
    c. Corrective Measures: Meet standards of quality of specified security grille and subject to acceptance of the Owner.

Adjusting And Cleaning

43. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave security grilles and hardware in proper operating condition.
44. Cleaning: Comply with requirements of Detailed Scope of Work.
    a. Clean security grilles after installation is completed to remove foreign matter and surface blemishes.
    b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

45. Installed Work: Protect security grilles from damage after installation.

END OF SECTION 08 34 53 00a

Task	Specification	Specification Description
08 34 53 00	08 11 63 13a	Security Window Screens and Doors
08 34 56 00	08 11 63 13a	Security Window Screens and Doors
08 34 56 00	08 34 53 00	Detention Doors And Frames
08 34 56 00	08 34 53 00a	Security Grilles
08 34 73 13	08 05 13 00	Steel Doors And Frames
08 34 73 13	08 12 13 13	Steel Entry Doors
08 34 73 13	08 12 13 13a	Stainless Steel Doors And Frames

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SECTION 08 34 73 16 - SOUND CONTROL DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for sound-control door assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Steel sound-control doors.
b. Wood sound-control doors.
c. Steel frames and sound-control seals.

C. Submittals
1. Product Data: For each type of product indicated. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
2. LEED Submittals:
a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body, **as directed**.
b. Product Data for Credit EQ 4.4: For adhesives and composite wood products, indicating that product contains no urea formaldehyde.
3. Shop Drawings: Include the following:
a. Elevations of each door design.
b. Details of sound-control seals, door bottoms, and thresholds.
c. Details of doors, including vertical and horizontal edge details and metal thicknesses.
d. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
e. Locations of reinforcement and preparations for hardware.
f. Details of each different wall opening condition.
g. Details of anchorages, joints, field splices, and connections.
h. Details of accessories.
i. Details of moldings, removable stops, and glazing.
j. Details of conduit and preparations for power, signal, and control systems.
4. Samples:
a. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
b. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; glazing; and hinge and other applied hardware reinforcement.
c. Frames: Include profile, corner joint, floor and wall anchors, and seals. Include separate section showing fixed sound panels if applicable.
5. Schedule: Provide a schedule of sound-control door assemblies prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.
6. Qualification Data: For qualified Installer, manufacturer, and acoustical testing agency.
7. Product Certificates: For each type of sound-control door assembly, from manufacturer.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of sound-control door assembly.
9. Field quality-control reports.
10. Maintenance Data: For sound-control door assemblies to include in maintenance manuals.

11. Warranty: Samples of special warranty.

D. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.
4. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, from single source from single manufacturer.
5. Sound Rating: Provide sound-control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
   a. STC Rating: As indicated on Drawings **OR** As indicated in the Door Schedule, **as directed**, as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.
6. Forest Certification: Provide doors made with cores **OR** veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
7. Fire-Rated Door Assemblies: Assemblies listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
8. Smoke- and Draft-Control Door Assemblies: Where indicated **OR** At corridors, smoke barriers, and smoke partitions, **as directed**, provide assemblies tested according to UL 1784.
   a. Air-Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m/m x sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
9. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   a. Provide additional protection to prevent damage to finish of factory-finished wood doors.
2. Shipping Spreaders: Deliver welded frames with two removable spreader bars across bottom of frames, tack welded or mechanically attached to jambs and mullions.
3. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high, wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
   a. If wrappers on doors become wet, remove cartons immediately. Provide a minimum of 1/4-inch (6-mm) space between each stacked door to permit air circulation.

F. Project Conditions
1. Environmental Limitations: Do not deliver or install wood sound-control wood doors until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
2. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

G. Coordination

1. Coordinate installation of anchorages for sound-control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.
a. Failures include, but are not limited to, the following:
1) Failure to meet sound rating requirements.
2) Faulty operation of sound seals.
3) Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
4) Wood doors that are warped (bow, cup, or twist) more than 1/4 inch (6 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
b. Warranty Period for Steel Doors: Five years from date of Final Completion.
c. Warranty Period for Wood Doors: Two years from date of Final Completion.

1.2 PRODUCTS

A. Steel Sound-Control Doors
1. Description: Provide flush-design sound-control doors, 1-3/4 inches (44 mm) thick, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC **OR** STC and fire, **as directed**, rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to ANSI/NAAMM-HMMA 865.
a. Exterior Doors: Fabricate from metallic-coated steel sheet 0.052-inch (1.32-mm) nominal thickness, or thicker as required to provide STC rating indicated.
b. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048-inch (1.21-mm) nominal thickness, or thicker as required to achieve STC rating indicated.
c. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
d. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches (150 mm) o.c.
e. Hardware Reinforcement: Same material as face sheets.
2. Materials:
a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
b. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 (Z180) zinc (galvanized) or A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.
d. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control **OR** sound-control and fire-rated-door labeling, **as directed**, requirements.
3. Finishes:
a. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1) Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
b. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with ANSI/SDI A250.3 for performance and acceptance criteria.

1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

B. Wood Sound-Control Doors
1. Description: Provide flush-design sound-control doors, 1-3/4 inches (44 mm) thick; with manufacturer's standard sound-retardant core as required to provide STC **OR** STC and fire, **as directed**, rating indicated. Fabricate according to WDMA 1.S.1-A.
2. Materials: Comply with Division 08 Section(s) "Flush Wood Doors" OR "Stile And Rail Wood Doors", **as directed**, for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.
   a. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control **OR** sound-control and fire-rated-door labeling, **as directed**, requirements.
3. Finishes:
   a. Factory finish sound-control wood doors to match doors specified in Division 08 Section(s) "Flush Wood Doors" OR "Stile And Rail Wood Doors", **as directed**.

C. Sound-Control Panels
1. Provide sound-control panels of same materials, construction, sound rating, and finish as specified for adjoining sound-control steel **OR** wood, **as directed**, doors.

D. Sound-Control Frames
1. Description: Fabricate sound-control door frames with corners mitered, reinforced, and continuously welded full depth and width of frame. Fabricate according to ANSI/NAAMM-HMMA 865.
   a. Weld frames according to NAAMM-HMMA 820.
   b. Exterior Frames: Fabricate from metallic-coated steel sheet 0.079-inch (2.01-mm) nominal thickness, or thicker as required to provide STC rating indicated.
   c. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch (1.90-mm) nominal thickness, or thicker as required to provide STC rating indicated.
   d. Sound-Control Panel Stops: Formed integral with frames, a minimum of 5/8 inch (16 mm) high, unless otherwise indicated.
   e. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 865 of same material as face sheets.
   f. Head Reinforcement: Reinforce frames with metallic-coated steel channel or angle stiffener, 0.108-inch (2.74-mm) nominal thickness, welded to head.
   g. Jamb Anchors:
      1) Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch (1.63-mm) nominal thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.156 inch (4.0 mm) thick.
      2) Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch (1.21-mm) nominal thickness uncoated steel unless otherwise indicated.
      3) Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-(9.5-mm-) diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
   h. Floor Anchors: Not less than 0.079-inch (2.01-mm) nominal thickness metallic-coated steel, and as follows:
      1) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
      2) Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.
   i. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide uncoated steel unless otherwise indicated.
   j. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch (0.6 mm) thick.

2. Materials:
   a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   b. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
   c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 (Z180) zinc (galvanized) or A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.
   d. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
   e. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
   f. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound-control door frames of type indicated.
   g. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
3. Finishes:
   a. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
      1) Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
   b. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
      1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

E. Sound-Control Hardware
1. Description: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC **OR** STC and fire, **as directed**, rating indicated.
   a. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.

      OR

      Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
   b. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
      1) Mounting: Mortised or semimortised into bottom of door or surface mounted on face of door as required by testing to achieve STC rating indicated.

      OR

      Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
   c. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch (13 mm) when door is fully open; with hardened pin; fabricated from stainless steel.
   d. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum **OR** stainless steel **OR** solid wood matching wood door faces, **as directed**.
      1) Finish: Clear **OR** Color, **as directed**, anodic finish.
      2) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
2. Other Hardware: Comply with requirements in Division 08 Section "Door Hardware".

F. Sound-Control Accessories
1. Glazing: Comply with requirements in Division 08 Section "Glazing"
2. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.
3. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Fabrication
1. Sound-Control Steel Door Fabrication: Sound-control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
   a. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
   b. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
   c. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
   d. Hardware Preparation: Factory prepare sound-control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in "Door Hardware".
      1) Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
      2) Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
   e. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 865.
2. Sound-Control Wood Door Fabrication: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels according to referenced quality standard, unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
   a. Comply with clearance requirements in NFPA 80 for fire-rated doors.
   b. Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
      1) Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
3. Sound-Control Frame Fabrication: Fabricate sound-control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
   a. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
   b. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   c. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   d. Jamb Anchors: Provide number and spacing of anchors as follows:
      1) Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         a) Two anchors per jamb up to 60 inches (1524 mm) in height.
         b) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.

c) Four anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
d) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.

2) Stud Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
a) Three anchors per jamb up to 60 inches (1524 mm) in height.
b) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
c) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
d) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
e) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal stud partitions.

3) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

e. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.

f. Hardware Preparation: Factory prepare sound-control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware".
1) Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
2) Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

g. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings in frames to be grouted.

h. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 865.

1.3 EXECUTION

A. Examination
1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of sound-control door assemblies.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound-control door frame connections before frame installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
2. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames to the following tolerances:
a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

C. Installation
1. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
2. Frames: Install sound-control door frames in sizes and profiles indicated.
   a. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      1) At fire-rated openings, install frames according to NFPA 80.
      2) At openings requiring smoke and draft control, install frames according to NFPA 105.
      3) Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
      4) Install sound-control frames with removable glazing stops located on secure side of opening.
      5) Remove temporary braces only after frames or bucks have been properly set and secured.
      6) Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      7) Apply corrosion-resistant coatings coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.
   b. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
      1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
   c. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
   d. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   e. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   f. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
   g. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
   h. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
      1) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      2) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
      3) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      4) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
3. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary.

a. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
   1) Jambs: 1/8 inch (3 mm).
   2) Head with Butt Hinges: 1/8 inch (3 mm).
   3) Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch (9.5 mm).
   4) Sill: Manufacturer's standard.
   5) Between Edges of Pairs of Doors: 1/8 inch (3 mm).

b. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.

4. Sound-Control Seals: Where seals have been prefit and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
5. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.
6. Thresholds: Set thresholds in full bed of sealant complying with requirements in Division 7 Section "Joint Sealants."
7. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with sound-control door assembly manufacturer's written instructions.
   a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Acoustical testing and inspecting agency shall select one sound-control door at random from sound-control door assemblies that are completely installed and perform testing for verification that assembly complies with STC rating requirements.
   a. Field tests shall be conducted according to ASTM E 336, with results calculated according to ASTM E 413. Acceptable field STC values shall be within 5 dB of laboratory STC values.
   b. Inspection Report: Acoustical testing agency shall submit report in writing to the Owner and Contractor within 24 hours after testing.
   c. If tested door fails, replace or rework all sound-control door assemblies to bring them into compliance at Contractor's expense.
      1) Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
3. Prepare test and inspection reports.

E. Adjusting And Cleaning
1. Final Adjustments: Check and adjust seals, door bottoms, and other sound-control hardware items right before final inspection. Leave work in complete and proper operating condition.
2. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
   a. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
3. Clean grout off sound-control door frames immediately after installation.
4. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
5. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

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SECTION 08 35 13 13 - FOLDING DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for folding doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Accordion folding doors.
b. Panel folding doors.
c. Bifold doors.
d. Bifold mirror doors.
e. Fire-rated folding doors.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, attachments to other work.
a. Fire-Release System: Describe system, including testing and resetting instructions.
b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each exposed product and for each color and texture specified.
4. Product Schedule: For folding doors. Use same designations indicated on Drawings.
5. Product certificates.
6. Maintenance data.

D. Quality Assurance
1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
2. Fire-Rated Folding Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B, **as directed**.
a. Oversize Fire-Rated Folding Doors: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Project Conditions
a. Environmental Limitations: Do not deliver or install folding doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
b. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication

1.2 PRODUCTS

A. Accordion Folding Doors
1. General: Top-supported, horizontal-sliding, manually operated accordion folding doors, with chain controlling the spacing and extension of pantographic or X-type accordion folding frames.

Inner and outer covers are continuous surface facings that attach to and completely cover the folding frames and are pleated as the door is retracted.

2. Outer Covering: Of type indicated below, complying with indicated surface-burning characteristics; attached to door support frames in a concealed manner at sufficient intervals to prevent sagging and separation and to permit on-site removal and repair, with vertical seams located in valleys and material hemmed at top and bottom.
   a. Vinyl reinforced with woven backing weighing not less than 20 oz./linear yd. (567 g/m).
      1) Color, Texture, and Pattern: As selected from manufacturer's full range.
   b. Fabric weighing not less than 16 oz./linear yd. (496 g/m), treated to resist stains.
      1) Color, Texture, and Pattern: As selected from manufacturer's full range.
   c. Manufacturer's standard nonwoven carpet, needle punched with fused fibers to prevent unraveling.
      1) Color, Texture, and Pattern: As selected from manufacturer's full range.
3. Sweep Seals: Manufacturer's standard top and bottom sweep seals on both **OR** one, **as directred**, side(s).
4. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation.
   a. Doors 96 Inches (2438 mm) High or Less: Nylon wheels on steel shafts.
   b. Doors More Than 96 Inches (2438 mm) High: Ball-bearing wheels with nylon tread and steel shafts.
5. Tracks: Manufacturer's standard metal track made of extruded aluminum or formed steel with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support accordion folding doors and enable their operation without damage to track, folding unit, or adjacent surfaces; complying with the following requirements:
   a. Head Trim: Prefinished wood molding for surface-mounted tracks.
   b. Center stop for center-opening partitions.
   c. Galvanized-steel sheet or aluminum subchannel for forming pocket for recessed suspension track.
   d. Metal ceiling contact guard to protect finished ceiling surface from damage by moving top sweep seals; with finish matching other exposed metal.
   e. Curved track sections with ceiling clips to accommodate configuration indicated.
   f. Glide switch to divert door to auxiliary track.
   g. Pivot switch to change track direction.
   h. Cross-track switch to allow one door to cross another.
6. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
   a. Finish: Clear-anodized aluminum **OR** Satin stainless steel **OR** Dull chromium-finish brass **OR** Dull chromium-finish steel, **as directed**.
   b. Latch: Operable from both **OR** one, **as directed**, side(s) of closed door with coin-slot release on opposite side, **as directed**.
   c. Lock: Manufacturer's standard key-operated cylinder lock, operable from both sides **OR** Manufacturer's standard key-operated cylinder lock, operable from one side; privacy lock on other side **OR** Deadlock to receive cylinder, operable from both sides. Refer to Division 08 Section "Door Hardware" for cylinder requirements **OR** Deadlock to receive cylinder, operable from both sides, **as directed**.
   d. Foot bolts on lead post where indicated. Secure to post to avoid interference with seals.
7. Jamb Molding: Manufacturer's standard wood or metal molding at closing jamb as required for light-tight jamb closure.
8. Lead Posts and Jamb Posts: Not less than 0.048-inch- (1.2-mm-) thick steel **OR** extruded aluminum, **as directed**, formed for rigidity and light seal at supporting construction.
   a. Nonferrous jamb strip for single-operating partitions to ensure tight closure by engaging rubber bumper on lead post.
9. Meeting Post: Fixed single jamb for single-stacked doors **OR** Center meeting post for center-opening doors, **as directed**.

10. Stacking: Tiebacks to maintain door in stacked position.
11. Stacking Configuration: Stack single doors at one end of opening **OR** center-opening doors at both ends of opening **OR** doors in pockets with hinged pocket doors, **as directed**.
12. Opening Size: As directed or as indicated on Drawings.

B. Panel Folding Doors
1. General: Top-supported, horizontal-sliding, manually operated panel folding doors, with panels joined by continuous hinge connectors for the full height of panels.
2. Core Material and Thickness: Manufacturer's standard.
3. Panel Width: 4-inch (100-mm) **OR** 5-inch (125-mm) **OR** 6-inch (150-mm) **OR** 8-inch (200-mm), **as directed**, nominal width.
4. Panel Facing: Facings that comply with indicated surface-burning characteristics.
   a. Vinyl Facing: Vinyl not less than 7 mils (0.175 mm) thick, factory bonded to core.
      1) Color and Texture: As selected from manufacturer's full range.
   b. Vinyl Facing with Woven Backing: Vinyl reinforced with woven backing weighing not less than 12 oz./linear yd. (372 g/m), factory bonded to core.
      1) Color and Texture: As selected from manufacturer's full range.
   c. Plastic-Laminate Facing: Grade VGS, high-pressure plastic laminate complying with NEMA LD 3; adhesive applied under pressure to core.
      1) Color, Texture, and Pattern: As selected from manufacturer's full range.
   d. Wood-Veneer Facing: as directed by the Owner, wood veneer, laminated to core, with manufacturer's standard clear **OR** stained, **as directed**, transparent finish.
      1) Stain Color: As selected from manufacturer's full range.
5. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation.
   a. Panels 5 Inches (125 mm) Wide or Less: Nylon wheels and axles.
   b. Panels More Than 5 Inches (125 mm) Wide: Ball-bearing wheels with nylon tread and steel shafts.
6. Tracks: Manufacturer's standard surface-mounted **OR** recessed, **as directed**, extruded-aluminum or steel track with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support operation without damage to track, folding unit, or adjacent surfaces; complying with the following requirements:
   a. Prefinished ceiling guard/channel for recessed tracks.
   b. Center stop for biparting partitions.
   c. Galvanized-steel sheet or aluminum subchannel for forming pocket for recessed suspension track.
   d. Nonferrous jamb strip for single-operating partitions to ensure tight closure by engaging rubber bumper on lead post.
   e. Curved track sections to accommodate configuration indicated.
   f. Glide switch to divert door to auxiliary track.
   g. Pivot switch to change track direction.
   h. Cross-track switch to allow one door to cross another.
7. Hinge Connector: Manufacturer's standard extruded-vinyl hinge connector.
   a. Color: As selected from manufacturer's full range **OR** Match or coordinate with facing color, **as directed**.
8. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
   a. Finish: Clear-anodized aluminum **OR** Satin stainless steel **OR** Dull chromium-finish brass **OR** Dull chromium-finish steel, **as directed**.
   b. Latch: Operable from both **OR** one, **as directed**, side(s) of closed door.
   c. Lock: Manufacturer's standard key-operated cylinder lock, operable from both sides **OR** Manufacturer's standard key-operated cylinder lock, operable from one side; privacy lock on other side **OR** Deadlock to receive cylinder, operable from both sides. Refer to Division 08 Section "Door Hardware" for cylinder requirements **OR** Deadlock to receive cylinder, operable from both sides, **as directed**.

d. Foot bolts on lead post where indicated. Secure to post to avoid interference with seals.

9. Jamb Molding: Manufacturer's standard wood or metal molding at closing jamb as required for light-tight jamb closure.
   a. Wood: Match species and finish of panel facing.
   b. Metal: Manufacturer's standard finish.
10. Wood Track Molding: Manufacturer's standard wood molding on each side of surface-mounted track to match species and finish of panel facings. Install with tight, hairline joints with all fasteners concealed.
11. Meeting Post: Fixed single jamb for single-stacked doors **OR** Center meeting post for biparting doors, **as directed**.
12. Stacking: Tiebacks to maintain door in stacked position.

C. Bifold Doors
1. General: Metal folding doors hinged together in pairs and supported on pivots at jamb, with floor and overhead track and door guide pins.
2. Metal Panels: Sizes as indicated, formed from nominal 0.024-inch- (0.6-mm-) thick, cold-rolled steel sheet. Channel form vertical edges and weld cross bracing to panel and channel-formed edges.
   a. Surface Profile: Fully louvered **OR** Flush **OR** Paneled **OR** Louvered and paneled, **as directed**.
   b. Configuration: Two **OR** Four, **as directed**,-panel bifold.
   c. Sheet Metal Texture: Smooth **OR** Simulated leather, **as directed**.
   d. Protective Finish: Hot-dip galvanized coating applied to panels, stiffeners, hinges, and decorative trim.
   e. Baked Finish: Baked-enamel factory finish in white **OR** ivory **OR** custom color as selected, **as directed**.
3. Hardware: Manufacturer's standard felt pads, screws, and pulls in standard finish. Hinges, pivots, and manufacturer's standard wheels factory installed and as follows:
   a. Hinges: 3 self-aligning hinges.
   b. Guides and Pivots: Not less than 5/16-inch- (7.9-mm-) diameter, adjustable screw-type, weight-bearing, zinc-plated pivot rod held in place by nylon rod clamp assemblies; with not less than 1/4-inch- (6.4-mm-) diameter, spring-loaded, self-aligning, zinc-plated steel guide rods and top pivot rods held in place by nylon sleeves.
   c. Track: Prefinished rolled steel with baked-enamel paint finish **OR** Aluminum extrusion, Alloy 6063-T5, 0.05 inch (1.3 mm) thick, with manufacturer's standard metal finish, **as directed**.

D. Bifold Mirror Doors
1. General: Folding doors hinged together in pairs and supported on pivots at jamb, with floor and overhead track and door guide pins.
2. Steel-Panel Door Construction: Sizes as indicated, flush profile, formed from nominal 0.024-inch- (0.6-mm-) thick, cold-rolled steel sheet. Channel form vertical edges and weld cross bracing to panel- and channel-formed edges. Attach mirrored glass facing to steel sheet by means of mechanically attached channels at top and bottom and by dual-faced cushion tape.
   a. Configuration: Two **OR** Four, **as directed**,-panel bifold.
   b. Protective Finish: Hot-dip galvanized coating applied to panels, stiffeners, hinges, and decorative trim.
   c. Baked Finish: Baked-enamel factory finish in white **OR** custom color as selected, **as directed**.
3. Metal-Framed Door Construction: Aluminum **OR** Steel, **as directed**, stiles and mechanically fitted rails with screw-attached stiffeners and with mirrored-glass facing attached securely to frames.
   a. Panel Style: Exposed **OR** Concealed, **as directed**, frame.
   b. Configuration: Two **OR** Four, **as directed**,-panel bifold.

c. Baked Finish: Electrostatically applied, baked-enamel factory finish in white **OR** custom color as selected, **as directed**.
d. Bright, Reflective Metallic Finish: Chrome **OR** Gold **OR** Selected from manufacturer's full range, **as directed**.

4. Mirror Facing: Smooth **OR** Beveled, **as directed**,-edged, silvered, mirrored, film-backed safety glass complying with 16 CFR 1201 for Category II safety glass; with ASTM C 1036 for Type I (transparent, flat), Class 1(clear), Quality q2 (mirror) annealed float glass; with the following:
   a. Glass Thickness: 3 mm thick for doors up to 84 inches (2133 mm) in height **OR** 4 mm thick for doors with height more than 84 inches (2133 mm), **as directed**.
   b. Edge Protection: Vertical mirror edges protected by metal **OR** Mylar, **as directed**, trim.
   c. Film-Backed Safety Mirrors: Apply film backing with pressure-sensitive adhesive coating over mirror-backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.
5. Hardware: Manufacturer's standard felt pads, screws, and pulls in standard finish. Hinges, pivots, and manufacturer's standard wheels factory installed and as follows:
   a. Hinges: 3 self-aligning hinges.
   b. Guides and Pivots: Manufacturer's standard.
   c. Guides and Pivots: Spring-loaded, zinc-plated steel guides and tops, and adjustable bottom pivot pins with nylon bushings and tips.
   d. Guides and Pivots: Not less than 5/16-inch- (7.9-mm-) diameter, adjustable screw-type, weight-bearing, zinc-plated pivot rod held in place by nylon rod clamp assemblies; with not less than 1/4-inch- (6.4-mm-) diameter, spring-loaded, self-aligning, zinc-plated steel guide rods and top pivot rods held in place by nylon sleeves.
6. Track: Prefinished rolled steel with baked-enamel paint finish **OR** Aluminum extrusion, Alloy 6063-T5, 0.05 inch (1.3 mm) thick, with manufacturer's standard metal finish, **as directed**.

E. Fire-Rated Folding Doors
1. General: Electrically **OR** Gravity-, **as directed**, operated, automatic- or self-closing, UL- or ITS-listed, biparting folding fire-rated assembly; top supported from overhead track or dual tracks without floor guides; complete with hardware, seals, track, closing devices, releasing devices, controls, pocket doors, and accessories necessary for intended operation and complying with the following requirements:
   a. Assembly remains in normal open (stacked) position. Signal from fire-alarm system initiates self-closing operation.
   b. Controls allow manual operation in either conventional or emergency mode. When opened manually during emergency mode, control mechanism automatically closes assembly.
2. Fire Rating: 1 **OR** 1-1/2 **OR** 3, **as directed**, hour(s).
3. Panel Construction: Formed-steel **OR** Formed stainless-steel, **as directed**, sheet panels connected by formed-steel **OR** formed stainless-steel, **as directed**, hinges.
4. Fire Insulation:
   a. Cover interior surface of both series of panels in parallel panel doors with continuous fire-resistive blanket secured to each panel with metal clip system.
   b. Extend fire insulation from bottom edge of panels to tracks and meet at interior centers of fixed jamb and lead post, forming an effective fire barrier.
5. Perimeter Seals and Closures: Manufacturer's standard vinyl or neoprene vertical seals, horizontal top and bottom seals, and closures identical to products tested for fire rating indicated, and forming an effective smoke and draft seal.
6. Track and Trolley System: 1 track or 2 parallel steel tracks on 8-inch (200-mm) centers, with ball-bearing roller trolleys and adjustable steel hanger rods for overhead support; designed for type of operation, size, and weight of fire-rated folding door indicated. Provide a continuous system of track sections and accessories identical to products tested for fire rating indicated, to accommodate configuration and layout indicated for door operation and storage.
7. Lead Posts: Formed from not less than 0.026-inch (0.66-mm-) thick steel **OR** stainless-steel, **as directed**, sheet, connected to door panels by specially adapted panels and equipped with manufacturer's standard handle on each side.
8. Electric Operators and Controls:

a. Operators: Factory-assembled power-drive unit consisting of motor, remote-located, **as directed**, control panel, limit switches, torque-limiting devices, clutch, reversing magnetic motor operator, leading-edge obstruction detectors, and key-switch control for conventional operation.
   1) Motor: 1/2 hp, controlled by reversing magnetic starter and equipped with overload protection.
   2) Limit Switches: To prevent overtravel.
   3) Roller Chain or Cable: Connected to lead posts by means of vertical stabilizer bar assembly.
   4) Drive Mechanism: Protected by torque limiter and emergency clutch.
   5) Travel Speed: 18 inches (450 mm) per second, maximum; 6 inches (150 mm) per second, minimum.

b. In case of fire, closing system is activated by building's fire- and smoke-detection equipment and automatically closes fire-rated folding doors.

c. Electrical Service: Equip for 120 V, single phase, 60-cycle ac.

d. Battery: Electrical current connects through relay to battery charger that continuously charges 12-V dc battery and automatically maintains battery at capacity. Automatic audible signal device sounds off if battery falls below or exceeds proper charge, power loss has occurred, or high-ac line voltage has been experienced.

e. Leading-Edge Obstruction Detector:
   1) Equip with pressure-sensitive leading edge that, on contact with an obstruction, causes door to stop and pause before attempting to re-close.
   2) Disable leading-edge obstruction detector until fire-rated folding door has opened pocket door.

f. Fire-rated folding doors can be manually opened at any time by pushing against leading edge.

g. Audible alarm sounds at automatic closing of door.

9. Accessories:
   a. Vision panels.
   b. Exit Hardware: Located on both sides of fire-rated folding door. In emergency mode, slight pressure on hardware causes door to open a minimum of 32 inches (812 mm), pause for 3 seconds, and then automatically close. Furnish hardware that can be field programmable to allow automatic opening distances of up to the entire opening width. In conventional mode, hardware is used to operate door and move it back into storage pocket.

10. Finishes:
   a. Baked-enamel finish for panels and hinges in colors selected from manufacturer's full range.
   b. Manufacturer's standard finish for handles.

11. Pocket Door:
   a. Solid-core pocket doors with reverse-action spring **OR** continuous, **as directed**, hinge; 90-degree minimum swing.
   b. Face Finish: Match adjacent finishes.
   c. Magnetic Catch: Holding force of no more than 30 lbf (133 N).
   d. Maximum Opening Force: 50 lbf (222 N).
   e. Bumper on interior side of pocket door as required by fire-rated folding door manufacturer to prevent interference with opening or retracting operation of fire-rated folding door.
   f. Coordinate pocket door sizes with fire-rated folding door manufacturer.

1.3 EXECUTION

A. Preparation

1. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings showing locations of anchorage devices and similar items.
2. In path of fire-rated folding doors, level floor with header to tolerance of plus or minus 1/16 inch (1.6 mm) across opening; grind or fill floor as necessary.

B. Installation
1. General: Install folding doors complying with manufacturer's written installation instructions. Install track in one piece.
   a. Comply with NFPA 80 for installing fire-rated folding doors.
2. Standard Floor Clearances: 1/4 to 3/4 inch (6.4 to 19 mm) maximum (above floor finish).
   a. Comply with NFPA 80 for clearances required for fire-rated folding doors.
3. Coordinate provisions for electrical service, sensing devices, and final connections for fire-rated folding doors.

C. Adjusting
1. Adjust units as necessary to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.
   a. Fire-Rated Folding Doors: Verify that all operations are functional and comply with requirements of authorities having jurisdiction.
2. Pocket Doors: Adjust to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.

D. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-rated folding doors.

END OF SECTION 08 35 13 13

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SECTION 08 36 13 00 - SECTIONAL OVERHEAD DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for sectional overhead doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes manually **OR** electrically, **as directed**, operated sectional doors with integral pass doors, **as directed**.

C. Performance Requirements
1. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
2. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   a. Wind Loads: As indicated on Drawings **OR** Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward, **as directed**.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
      2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
   b. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.
4. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283 **OR** DASMA 105, **as directed**.
   a. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. (0.406 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h).
5. Windborne-Debris-Impact-Resistance Performance: Provide sectional doors **OR** glazed sectional doors, **as directed**, that pass large-missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996 **OR** DASMA 115, **as directed**.
6. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. Seismic Component Importance Factor: 1.5 **OR** 1.0, **as directed**.
7. Operation Cycles: Provide sectional door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Submittals
1. Product Data: For each type and size of sectional door and accessory.
2. LEED Submittal:
   a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body, **as directed**. Include statement indicating costs for each certified wood product.

3. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   a. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each exposed product and for each color and texture specified.
5. Delegated-Design Submittal: For sectional doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Seismic Qualification Certificates: For sectional doors**,** accessories, and components, from manufacturer.
7. Maintenance data.
8. Warranties: Sample of special warranties.

E. Quality Assurance
1. Wood Door Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
3. Forest Certification: Provide wood doors made with not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.
6. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1, **as directed**.

F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within Two **OR** Five, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within 10 years from date of Final Completion.

1.2 PRODUCTS

A. Steel Door Sections
1. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
   a. Fabricate section faces from single sheets to provide sections not more than 24 inches (610 mm) high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
   b. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
2. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- (1.63-mm-) nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than

0.064-inch- (1.63-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.

3. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal, **as directed**.
4. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites, **as directed**.
5. Provide reinforcement for hardware attachment.
6. Board Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polystyrene or polyurethane board insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84; or with glass-fiber-board insulation. Secure insulation to exterior face sheet. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
   a. Interior Facing Material:
      1) Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
      2) Manufacturer's standard prefinished hardboard panel, 1/8 inch (3 mm) thick and complying with ANSI A135.5.
7. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
   a. Interior Facing Material:
      1) Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
      2) Manufacturer's standard prefinished hardboard panel, 1/8 inch (3 mm) thick and complying with ANSI A135.5.
8. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

B. Wood Door Sections
1. Paneled Sections: Fabricate stiles and rails of clear, vertical-grain, straight, kiln-dried Douglas fir, West Coast hemlock, or Sitka spruce, not less than 1-3/4 inches (44 mm) thick. Form meeting rails to provide rabbeted, weathertight-seal joint.
   a. Panel Inserts: Tempered hardboard, 1/4 inch (6 mm) thick, smooth on two sides, complying with ANSI A135.4.
   b. Glazed Panel Inserts: 6-mm-thick, clear float glass, complying with ASTM C 1036, Type I, Class 1, Quality Q3, with removable glazing stops of same wood as stiles and rails.
2. Flush Sections: Construct flush wood door sections with top, bottom, and end closures of clear, vertical-grain, straight, kiln-dried Douglas fir, West Coast hemlock, or Sitka spruce. Provide wood blocking to receive hardware, end stiles, and frames for glazing, glued and doweled in place. Form meeting rails to provide rabbeted weathertight-seal joint.
   a. Core: Manufacturer's standard polystyrene or polyurethane board insulation or honeycomb core complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Bond to facing.
   b. Facing: 1/8-inch- (3-mm-) thick, tempered hardboard complying with ANSI A135.4 and smooth on one side.
3. Fabricate sections of mortise-and-tenon construction with waterproof glue and steel dowels, or of rabbeted construction with waterproof glue and steel dowels and pins.
4. Reinforce sections with continuous horizontal and diagonal galvanized-steel members as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.

5. Treat wood door members after machining with water-repellent preservative formulation according to WDMA I.S. 4.
6. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, deformation, and delamination.
7. Factory prime door sections with one coat of exterior primer compatible with field-applied finish, applied at a minimum dry film thickness of 1 mil (0.025 mm).

C. Aluminum Door Sections
1. Sections: Construct door sections with stiles and rails formed from extruded-aluminum shapes, complying with ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, with wall thickness not less than 0.065 inch (1.7 mm) for door section 1-3/4 inches (44 mm) deep. Fabricate sections with stile and rail dimensions and profiles shown on Drawings. Join stiles and rails by welding or with concealed, 1/4-inch- (6-mm-) minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint.
   a. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
   b. Provide reinforcement for hardware attachment.
2. Solid Panels: Fabricate of aluminum sheet, complying with ASTM B 209 (ASTM B 209M), alloy and temper standard with manufacturer for type of use and finish indicated, not less than 0.040 inch (1.02 mm) thick, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.
3. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with 6-mm-thick, clear acrylic glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

D. Translucent Door Sections
1. Construct door sections of not less than 0.063-inch- (1.6-mm-) thick, extruded-aluminum stiles and rails complying with ASTM B 221 (ASTM B 221M) and with alloy and temper recommended by manufacturer for type of use and finish indicated, to provide door sections at least 1-3/4 inches (44 mm) deep. Fabricate units with overlapped or interlocked weathertight-seal joints at meeting rails. Reinforce or truss each section as required for strength and rigidity. Provide reinforcement for hardware attachment.
2. Provide translucent, ribbed, glass-fiber-reinforced plastic panels, secured and sealed watertight to framing, and reinforced to meet performance requirements.

E. Tracks, Supports, And Accessories
1. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653/A 653M for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
2. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
   a. Vertical Track Assembly: Track with continuous reinforcing angle attached to track and attached to wall with jamb brackets **OR** wall jamb brackets attached to track and attached to wall, **as directed**.
   b. Horizontal Track Assembly: Track with continuous reinforcing angle attached to track and supported at points from curve in track to end of track by laterally braced attachments to overhead structural members.

3. Removable Center Posts: Manufacturer's standard carry-away **OR** roll-away **OR** swing-up, **as directed**, type for multiple doors in one opening.
4. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
5. Windows: Manufacturer's standard window units of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door-section frames.
6. Pass Doors: Manufacturer's standard pass doors where indicated, complete with glazing, operating hardware, and mortise lock. Construct pass doors of same materials, design, and finish as sectional door assembly.
   a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
   b. Keys: Two **OR** Three, **as directed**, for each cylinder.

F. Hardware
1. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
2. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.
3. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.
4. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

G. Locking Devices
1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
   b. Keys: Two **OR** Three, **as directed**, for each cylinder.
3. Chain Lock Keeper: Suitable for padlock.
4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

H. Counterbalance Mechanism
1. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
2. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.
3. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance

mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 feet (4.88 m) long unless closer spacing is recommended by door manufacturer.

4. Cables: Galvanized-steel lifting cables with cable safety factor of at least 5 **OR** 7, **as directed**, to 1.
5. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
6. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
7. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

I. Manual Door Operators
1. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
2. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).
3. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) **OR** 35-lbf (155-N), **as directed**, force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

J. Electric Door Operators
1. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   a. Comply with NFPA 70.
   b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
3. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
   a. Trolley: Trolley operator mounted to ceiling above and to rear of door in raised position and directly connected to door with drawbar.
   b. Jackshaft, Center Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.
   c. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements For Equipment", unless otherwise indicated.
   a. Electrical Characteristics:
      1) Phase: Single phase **OR** Polyphase, **as directed**.
      2) Volts: 115 **OR** 208 **OR** 230 **OR** 460, **as directed**, V.
      3) Hertz: 60.
   b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
   c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.

d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
f. Use adjustable motor-mounting bases for belt-driven operators.

5. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
6. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
   a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
      1) Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensor device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
   b. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      1) Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.
7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
   a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
   b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
8. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N) **OR** 35 lbf (155 N), **as directed**.
9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
12. Radio-Control System: Consisting of the following:
    a. Three-channel universal coaxial receiver to open, close, and stop door; one **OR** two, **as directed**, per operator.
       OR
       Multifunction remote control.
       OR
       Remote antenna and mounting kit.

K. Door Assembly
1. Steel **OR** Wood **OR** Aluminum **OR** Full-Vision Aluminum **OR** Translucent, **as directed**, Sectional Door: Sectional door formed with hinged sections.
2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
3. R-Value **OR** Installed R-Valu, **as directed**: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) **OR** 12.0 deg F x h x sq. ft./Btu (2.113 K x sq. m/W) **OR** 15.0 deg F x h x sq. ft./Btu (2.642 K x sq. m/W) **OR** 17.5 deg F x h x sq. ft./Btu (3.082 K x sq. m/W), **as directed**.
4. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 (Z180) **OR** G90 (Z275), **as directed**, zinc coating.

a. Section Thickness: 1-3/8 inches (35 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm), **as directed**.
b. Exterior-Face, Steel Sheet Thickness: 0.064-inch- (1.63-mm-) **OR** 0.040-inch- (1.02-mm-) **OR** 0.028-inch- (0.71-mm-) **OR** 0.022-inch- (0.56-mm-) **OR** 0.019-inch- (0.48-mm-), **as directed**, nominal coated thickness.
1) Surface:
a) Flat.
OR
Manufacturer's standard, grooved **OR** ribbed **OR** paneled **OR** wood-grain embossed, **as directed**.
c. Insulation: Board **OR** Foamed in place, **as directed**.
d. Interior Facing Material: Zinc-coated (galvanized) steel sheet of 0.028-inch- (0.71-mm-) **OR** 0.022-inch- (0.56-mm-) **OR** 0.019-inch- (0.48-mm-) **OR** manufacturer's recommended thickness to meet performance requirements, **as directed**, nominal coated thickness.
e. Interior Facing Material: Hardboard panel.

5. Wood Sections: Paneled **OR** Flush, **as directed**, and with manufacturer's standard insulation, **as directed**.
6. Aluminum Sections: Solid panels **OR** Full vision, **as directed**, with manufacturer's standard, nonglazed panels across bottom section of door, **as directed**.
7. Translucent Sections: Manufacturer's standard with manufacturer's standard, nonglazed panels across bottom section of door, **as directed**.
8. Track Configuration: Standard-lift **OR** Low-headroom **OR** High-lift **OR** Vertical-lift **OR** Contour, **as directed**, track with removable center post shared with adjacent door, **as directed**.
9. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge, **as directed**.
10. Windows: Approximately 24 by 7 inches (610 by 178 mm) **OR** 24 by 11 inches (610 by 279 mm), **as directed**, with curved corners, **OR** with square corners, **as directed**, and spaced apart the approximate distance as indicated on Drawings; in one row **OR** two rows, **as directed**, at height indicated on Drawings; installed with glazing **OR** insulated glazing, **as directed**, of the following type:
a. Clear Float Glass: 3 mm thick and complying with ASTM C 1036, Type I, Class 1, Quality Q3.
b. Clear Acrylic Plastic: 3 mm thick, transparent, smooth or polished, and formulated to be UV resistant.
c. Clear Polycarbonate Plastic: 3-mm-thick, transparent, fire-retardant, UV-resistant, polycarbonate sheet manufactured by extrusion process.
d. Insulating Glass: Manufacturer's standard.
11. Pass Door: As shown.
12. Roller-Tire Material: Case-hardened steel **OR** Neoprene or bronze **OR** Manufacturer's standard, **as directed**.
13. Locking Devices: Equip door with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumbturn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside, with cylinders, **as directed**.
14. Counterbalance Type: Torsion spring **OR** Weight counterbalance, **as directed**.
15. Manual Door Operator: Push-up operation **OR** Chain-hoist operator, **as directed**.
16. Electric Door Operator:
a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
b. Operator Type: Trolley **OR** Jackshaft, center mounted **OR** Jackshaft, side mounted **OR** As shown on Drawings, **as directed**.
c. Motor Exposure: Interior, clean, and dry **OR** Exterior, dusty, wet, or humid, **as directed**.
d. Emergency Manual Operation: Push-up **OR** Chain, **as directed**, type.

e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
   1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
g. Other Equipment: Audible and visual signals **OR** Radio-control system, **as directed**.

17. Door Finish:
   a. Aluminum Finish: Clear anodized **OR** Bronze anodized **OR** Anodized color matching sample **OR** Anodized color as selected from manufacturer's full range, **as directed**.
   b. Baked-Enamel or Powder-Coated Finish: Color and gloss as selected from manufacturer's full range.
   c. Factory Prime Finish: Manufacturer's standard color.
   d. Finish of Interior Facing Material: Match finish of exterior section face **OR** Finish as selected from manufacturer's full range, **as directed**.

L. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

M. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

N. Steel And Galvanized-Steel Finishes
1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

1.3 EXECUTION

A. Installation
1. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
2. Tracks:
   a. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches (610 mm) apart.
   b. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
   c. Repair galvanized coating on tracks according to ASTM A 780.
3. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

B. Startup Services
   1. Engage a factory-authorized service representative to perform startup service.
      a. Complete installation and startup checks according to manufacturer's written instructions.
      b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Adjusting
   1. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   2. Lubricate bearings and sliding parts as recommended by manufacturer.
   3. Adjust doors and seals to provide weathertight fit around entire perimeter.
   4. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.
   5. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

END OF SECTION 08 36 13 00

Task	Specification	Specification Description
08 36 13 00	08 33 23 11	Overhead Coiling Doors

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SECTION 08 38 13 00 - FLEXIBLE DOORS

1.1 GENERAL

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

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

1.2 PRODUCTS

A. General: Each new door unit shall be a complete unit produced by one manufacturer including hardware, accessories, mounting, and installation components.

B. Door Panels: Door panels shall be constructed of the following materials.
1. Heavy-Duty, Abrasive-Resistant Rubber, 60 durometer, roto-cured process, 2,200 psi tensile strength. Panel thickness shall be l/2- inch. Lower door panel shall be reinforced with additional rubber extrusions bonded horizontally to the door facing on 8 inch centers.
2. Flexible Polycarbonate transparent panels 1/2 inch thick.
3. Flexible Polyvinylchloride (PVC) transparent panels min. 0.196 inch (5mm) thick.
4. Flexible Polyvinylchloride (PVC) opaque panels min. 0.196 inch (5mm) thick.

C. Door Facings shall be high strength fabric reinforced vinyl bonded to door frame. Facing shall not be mechanically fastened.

D. The Vision Panels shall be double glazed, damage resistant with optical clarity exceeding 90%. Vision Panels shall be mounted flush.

E. Door Panels shall be single or double-acting, as required.

F. Panel Frame: Framing materials to which door panels shall be secured shall be galvanized steel, ASTM A525, 11 gauge. Door panels shall be suspended between L-shaped rolled formed rails and stiles by removable bolt and nut connectors.

G. Hardware shall conform to the requirements of ASTM A 164 or ASTM A 386, as required.
1. Hinges shall be adjustable spring-type gravity self-lubricating hinges.
2. Magnetic Catch shall be provided at door overlap at pair of door panels to give positive closure.
3. Header and Jamb Seals shall be door mounted PVC seals at head and jamb.
4. Bumpers shall be center or bottom bumpers.
5. Jamb Guards shall be formed steel guards to enclose and protect lower hinge hardware and closures.

H. Door Jamb shall be constructed of steel tube, ASTM A 500, with integral wall anchors, galvanized in compliance with ASTM A 386 or stainless steel bent plate, Type 304, with integral wall anchors, as required.

I. Finish: All ferrous metal parts shall be finish-coated with polyurethane paint.

J. Fire Hazard Classification: All door material shall have a fire hazard classification determined by ASTM E 84. Provide materials with the following fire hazard classifications:
Flame spread not more than 25.
Smoke developed not more than 50.

K. Vertical PVC Vinyl Strip Doors
1. Door shall consist of overlapping transparent minimum PVC strips with pre-punched galvanized hanger brackets which mate with formed metal arms on the universal hardware.
2. Hardware shall provide full swivel action. A cover plate shall prevent accidental removal.
3. End Strips shall be orange to frame opening. Strips shall have rounded edges and overlap to form a seal.

1.3 EXECUTION

A. Products shall be installed per manufacturer's written instruction. Products shall be firmly attached to adjacent materials. Products shall be installed level and plumb and shall be demonstrated to operate properly and as intended for a complete installation.

END OF SECTION 08 38 13 00

Task	Specification	Specification Description
08 38 16 00	08 05 13 00	Steel Doors And Frames
08 38 16 00	08 12 13 13	Steel Entry Doors
08 38 16 00	08 12 13 13a	Stainless Steel Doors And Frames
08 38 19 00	08 05 13 00	Steel Doors And Frames
08 38 19 00	08 12 13 13	Steel Entry Doors
08 38 19 00	08 12 13 13a	Stainless Steel Doors And Frames

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SECTION 08 42 13 00 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for aluminum framed entrances and storefronts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Exterior and interior storefront framing.
b. Storefront framing for window walls.
c. Storefront framing for ribbon walls.
d. Storefront framing for punched openings.
e. Exterior and interior manual-swing entrance doors and door-frame units.

C. Definitions
1. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

D. Performance Requirements
1. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
a. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
b. Dimensional tolerances of building frame and other adjacent construction.
c. Failure includes the following:
1) Deflection exceeding specified limits.
2) Thermal stresses transferring to building structure.
3) Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
4) Glazing-to-glazing contact.
5) Noise or vibration created by wind and by thermal and structural movements.
6) Loosening or weakening of fasteners, attachments, and other components.
7) Sealant failure.
8) Failure of operating units.
2. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Loads:
a. Wind Loads: As indicated on Drawings **OR as directed**.
1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
4. Deflection of Framing Members:
a. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite **OR** 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m), **as directed**, or an

amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.

b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below them to less than 1/16 inch (1.5 mm), **as directed**.

5. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   a. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   b. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.
6. Windborne-Debris-Impact-Resistance Performance: Provide aluminum-framed systems that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**.
   a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
   b. Small-Missile Impact: For aluminum-framed systems located more than 30 feet (9.1 m) above grade.
7. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
   a. Design Displacement: As indicated on Drawings **OR as directed**.
   b. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.
8. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
9. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
10. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
    a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.
11. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
    a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
    b. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

1) High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
2) Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).

c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

12. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 **OR** 53, **as directed**, when tested according to AAMA 1503.
13. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, when tested according to AAMA 1503.
14. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
    a. Sound Transmission Class (STC): Minimum 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
    b. Outdoor-Indoor Transmission Class (OITC): Minimum 26 **OR** 30 **OR** 34, **as directed**, OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
15. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
    a. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
    b. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
16. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
    a. Product Data for Credit EQ 4.1: For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
    a. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
    b. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
4. Samples: For each type of exposed finish required.
5. Other Action Submittals:
    a. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
6. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
7. Seismic Qualification Certificates: For aluminum-framed systems**,** accessories, and components, from manufacturer.
    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Welding certificates.

9. Product Test Reports.
10. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.
11. Field quality-control reports.
12. Maintenance Data.
13. Warranties: Sample of special warranties.

F. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
3. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
4. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.
5. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   a. Do not revise intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If revisions are proposed, submit comprehensive explanatory data to the Owner for review.
6. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1, **as directed**.
7. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
8. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.
9. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.
10. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
11. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within two **OR** five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion. Warranty does not include normal weathering.

1.2 PRODUCTS

A. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).

b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
c. Extruded Structural Pipe and Tubes: ASTM B 429.
d. Structural Profiles: ASTM B 308/B 308M.
e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

B. Framing Systems
1. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
a. Construction: Nonthermal **OR** Thermally improved **OR** Thermally broken **OR** Structurally glazed, **as directed**.
b. Glazing System: Retained mechanically with gaskets on four sides **OR** Retained by structural sealant at vertical edges and mechanically with gaskets at horizontal edges, **as directed**.
c. Glazing Plane: As indicated **OR** Front **OR** Center **OR** Back **OR** Multiplane, **as directed**.
2. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
b. Reinforce members as required to receive fastener threads.
c. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system **OR** fabricated from stainless steel, **as directed**.
4. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
5. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer, **as directed**.
6. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Glazing Systems
1. Glazing: As specified in Division 08 Section "Glazing".
2. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
3. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
4. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
5. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
a. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
1) Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) Color: Black **OR** As selected from manufacturer's full range of colors, **as directed**.

b. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

1) Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) Color: Matching structural sealant.

D. Entrance Door Systems

1. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

a. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) **OR** 2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-) **OR** 2- to 2-1/4-inch (50.8- to 57.2-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-), **as directed**, thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

1) Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

b. Door Design: As indicated **OR** Narrow stile; 2-1/8-inch (54-mm) nominal width **OR** Medium stile; 3-1/2-inch (88.9-mm) nominal width **OR** Wide stile; 5-inch (127-mm) nominal width, **as directed**.

1) Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

c. Glazing Stops and Gaskets: Beveled **OR** Square, **as directed**, snap-on, extruded-aluminum stops and preformed gaskets.

1) Provide nonremovable glazing stops on outside of door.

E. Entrance Door Hardware

1. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule **OR** and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article, **as directed**, for each entrance door to comply with requirements in this Section.

a. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products **OR** products equivalent in function and comparable in quality to named products **OR** products complying with BHMA standard referenced, **as directed**.

b. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

c. Opening-Force Requirements:

1) Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf ((133 N))to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.

2) Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

2. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

a. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

3. Opening-Force Requirements:

a. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 lbf (67 N) for not more than 3 seconds.

b. Latches and Exit Devices: Not more than 15 lbf (67 N) required to release latch.

4. Pivot Hinges: BHMA A156.4, Grade 1.

a. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

5. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
   a. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
   b. Exterior Hinges: Stainless steel, with stainless-steel pin **OR** Nonferrous, **as directed**.
   c. Quantities:
      1) For doors up to 87 inches (2210 mm) high, provide 3 hinges per leaf.
      2) For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide 4 hinges per leaf.
6. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.
7. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
8. Manual Flush Bolts: BHMA A156.16, Grade 1.
9. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
10. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
11. Cylinders: As specified in Division 08 Section "Door Hardware" **OR** BHMA A156.5, Grade 1, **as directed**.
    a. Keying: No master **OR** Master, **as directed**, key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE" **OR** to be furnished by Owner, **as directed**.
12. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
13. Operating Trim: BHMA A156.6.
14. Removable Mullions: BHMA A156.3, extruded aluminum.
    a. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.
15. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to meet field conditions and requirements for opening force.
16. Concealed Overhead Holders: BHMA A156.8, Grade 1.
17. Surface-Mounted Holders: BHMA A156.16, Grade 1.
18. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
19. Weather Stripping: Manufacturer's standard replaceable components.
    a. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
    b. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
20. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
21. Silencers: BHMA A156.16, Grade 1.
22. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm).
23. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

F. Accessory Materials
1. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants".
   a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

G. Fabrication
1. Form or extrude aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   d. Physical and thermal isolation of glazing from framing members.
   e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   f. Provisions for field replacement of glazing from exterior **OR** interior **OR** interior for vision glass and exterior for spandrel glazing or metal panels, **as directed**.
   g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
4. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
5. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
6. Storefront Framing: Fabricate components for assembly using shear-block system **OR** screw-spline system **OR** head-and-sill-receptor system with shear blocks at intermediate horizontal members, **as directed**.
7. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   a. At exterior doors, provide compression weather stripping at fixed stops.
   b. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
8. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   a. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   b. At exterior doors, provide weather sweeps applied to door bottoms.
9. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
10. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

H. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

a. Color and Gloss: Match sample **OR** As selected from manufacturer's full range, **as directed**.

4. High-Performance Organic Finish:
   a. 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   OR
   3-coat **OR** 4-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      1) Color and Gloss: Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation
1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmovement joints.
   e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   f. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
   a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
   b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
5. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
6. Install glazing as specified in Division 08 Section "Glazing".
   a. Structural-Sealant Glazing:
      1) Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
      2) Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
7. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   a. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   b. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
8. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

B. Erection Tolerances

1. Install aluminum-framed systems to comply with the following maximum erection tolerances:
   a. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   b. Alignment:
      1) Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
      2) Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
2. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

C. Field Quality Control
1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.
2. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
   a. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
      1) Destructive Test Method A, "Hand Pull Tab (Destructive)," in ASTM C 1401, Appendix X2, shall be used.
         a) A minimum of two **OR** four **OR** six, **as directed**, areas on each building face shall be tested.
         b) Repair installation areas damaged by testing.
   b. Structural-Sealant Glazing Inspection: After installation of aluminum-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to recommendations in ASTM C 1401.
   c. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
   d. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. (200 Pa), and shall not evidence water penetration.
   e. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.
3. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
5. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
6. Prepare test and inspection reports.

D. Adjusting
1. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   a. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION 08 42 13 00

SECTION 08 42 26 00 - ALL-GLASS ENTRANCES AND STOREFRONTS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for all-glass entrances and storefronts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Interior **OR** Exterior **OR** Interior and exterior, **as directed**, manual-swinging **OR** manual-sliding, **as directed**, all-glass entrance doors.
b. All-glass sidelights and transoms.
c. Interior **OR** Exterior **OR** Interior and exterior, **as directed**, all-glass storefronts.

C. Definitions
1. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

D. Performance Requirements
1. General Performance: All-glass systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Structural Performance: All-glass systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
a. Wind Loads: **As directed**.
1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
2) Importance Factor.
3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
b. Seismic Loads: **As directed**.
c. Deflection Limits: Deflection normal to glazing plane is limited to 1 inch (25 mm) **OR** 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, **as directed**.
3. Delegated Design: Design all-glass systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Thermal Movements: Allow for thermal movements resulting from the following ambient and surface temperature changes.
a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation details, including the following:
a. Plans, elevations, and sections.
b. Details of fittings and glazing, including isometric drawings of patch fittings **OR** rail fittings **OR** patch and rail fittings, **as directed**.
c. Door hardware locations, mounting heights, and installation requirements.
3. Samples: For each type of exposed finish required

4. Delegated-Design Submittal: For all-glass systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Seismic Qualification Certificates
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranty: Sample of special warranty.

F. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
3. Engineering Responsibility: Prepare data for all-glass systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
4. Source Limitations: Obtain all-glass systems from single source from single manufacturer.
5. Accessible All-Glass Entrance Doors: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
6. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within two years from date of Final Completion

1.2 PRODUCTS

A. Materials
1. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.
   a. Class 1: Clear monolithic.
      1) Thickness: 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
      2) Locations: As directed.
   b. Class 2: Tinted monolithic.
      1) Color: Gray **OR** Bronze, **as directed**.
      2) Thickness: 3/8 inch (10 mm) **OR** 1/2 inch (13 mm), **as directed**.
      3) Locations: As directed.
   c. Exposed Edges: Machine ground and flat polished.
   d. Butt Edges: Flat ground.
   e. Corner Edges: Lap-joint corners with exposed edges polished.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5.
   a. Bronze Cladding: ASTM B 36/B 36M, alloy matching sample **OR** UNS No. C28000 (muntz metal, 60 percent copper) **OR** UNS No. C22000 (commercial bronze, 90 percent copper) **OR** as standard with manufacturer, **as directed**.
   b. Brass Cladding: ASTM B 36/B 36M, alloy matching sample **OR** UNS No. C26000 (cartridge brass, 70 percent copper) **OR** UNS No. C28000 (muntz metal, 60 percent copper) **OR** as standard with manufacturer, **as directed**.
   c. Stainless-Steel Cladding: ASTM A 666, Type 304.

B. Metal Components
1. Fitting Configuration:
a. Manual-Swinging, All-Glass Entrance Doors Sidelights and Transoms: Patch fittings at head and sill on pivot side only **OR** Patch fittings at head and sill on pivot side, and for lock at sill of swing side **OR** Patch fitting at top and continuous rail fitting at bottom **OR** Continuous rail fitting at top and bottom, **as directed**.
b. Manual-Sliding, All-Glass Entrance Doors Sidelights and Transoms: Continuous rail fitting at top and bottom.
c. All-Glass Storefronts: Recessed glazing channel at top and continuous rail fitting at bottom **OR** Recessed glazing channel at top and bottom **OR** Continuous rail fitting at top and bottom, **as directed**.
2. Patch Fittings: Aluminum **OR** Bronze-clad aluminum **OR** Brass-clad aluminum **OR** Stainless-steel-clad aluminum, **as directed**.
3. Rail Fittings:
a. Material: Match patch-fitting metal and finish **OR** Aluminum **OR** Bronze-clad aluminum **OR** Brass-clad aluminum **OR** Stainless-steel-clad aluminum, **as directed**.
b. Height:
1) Top Rail: 3-1/2 inches (89 mm) **OR** As indicated, **as directed**.
2) Bottom Rail: 3-1/2 inches (89 mm) **OR** 10 inches (255 mm) **OR** As indicated, **as directed**.
c. Profile: Tapered **OR** Tapered flat **OR** Tapered at 60 degrees minimum from the horizontal **OR** Square **OR** Curved **OR** As indicated, **as directed**.
d. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
4. Accessory Fittings: Match patch-fitting **OR** rail-fitting **OR** patch- and rail-fitting, **as directed**, metal and finish for the following:
a. Overhead doorstop.
b. Center-housing lock.
c. Glass-support-fin brackets.
5. Anchors and Fastenings: Concealed.
6. Weather Stripping: Pile type; replaceable without removing all-glass entrance doors from pivots.

C. Fabrication
1. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
a. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
2. Factory assemble components and factory install hardware and fittings to greatest extent possible.

D. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.

E. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
c. Directional Satin Finish: No. 4.
d. Mirrorlike Reflective, Nondirectional Polish: No. 8.

F. Copper-Alloy Finishes

1. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
   a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
2. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
   a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
3. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide).
   a. Color: Match sample.

1.3 EXECUTION

A. Installation
1. Install all-glass systems and associated components according to manufacturer's written instructions.
2. Set units level, plumb, and true to line, with uniform joints.
3. Maintain uniform clearances between adjacent components.
4. Lubricate hardware and other moving parts according to manufacturer's written instructions.
5. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
6. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce weathertight installation.

B. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. After completion of all-glass storefront installation and nominal curing of sealant and glazing compounds, but before installation of interior finishes, test for water leaks according to AAMA 501.2.
3. Perform test for total areas as designated.
4. Work will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

C. Adjusting And Cleaning
1. Adjust all-glass entrance doors and hardware to produce smooth operation and tight fit at contact points and weather stripping.
   a. For all-glass entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.
2. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 08 42 26 00

SECTION 08 42 29 23 - ICU/CCU ENTRANCE DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for ICU/CCU entrance doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes manually operated ICU/CCU entrances.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: For ICU/CCU entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
3. Samples: For each exposed product and for each color and texture specified.
4. Warranties: Sample of special warranties.

D. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
2. Preinstallation Conference: Conduct conference at Project site.

E. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ICU/CCU entrances that fail in materials or workmanship within two years from date of Final Completion.
2. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   b. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.
3. Brass Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in entrance manufacturer's standard thickness.
4. Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in entrance manufacturer's standard thickness.
5. Sealants and Joint Fillers: As specified in Division 07 Section "Joint Sealants".
6. Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout complying with ASTM C 1107; of consistency suitable for application.
7. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

B. ICU/CCU Entrance Assemblies

1. General: Provide manufacturer's standard factory-glazed, **as directed**, ICU/CCU entrances including door leaves, sidelites, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation.
2. Opening-Force Requirement, Sliding: Not more than 5 lbf (22.2 N) to fully open door.
3. ICU/CCU Entrance:
   a. Configuration:
      1) Single-sliding two-panel door, with one operable leaf and sidelite; with breakaway capability for sliding leaf only **OR** for sliding leaf and sidelite **OR** as indicated on Drawings, **as directed**.
      2) Configuration: Single-sliding three-panel door, with one operable leaf and two sidelites; with breakaway capability for sliding leaf only **OR** for sliding leaf and one sidelite **OR** for sliding leaf and both sidelites **OR** as indicated on Drawings, **as directed**.
      3) Configuration: Biparting-sliding four-panel door, with one operable leaf and sidelite on each side; with breakaway capability for sliding leaves only **OR** for sliding leaves and both sidelites **OR** as indicated on Drawings, **as directed**.
      4) Configuration: Single-telescoping three-panel door, with two operable leaves and one sidelite; with breakaway capability for sliding leaves only **OR** for sliding leaves and sidelite **OR** as indicated on Drawings, **as directed**.
      5) Configuration: Biparting-telescoping six-panel door, with two operable leaves and one sidelite on each side; with breakaway capability for sliding leaves only **OR** for sliding leaves and both sidelites **OR** as indicated on Drawings, **as directed**.
   b. Mounting: Between jambs **OR** Surface, **as directed**.
   c. Floor Track Configuration: No track across sliding-door opening and at sidelites (trackless) **OR** recessed, pin-guide track system at sidelites **OR** surface-mounted, roller-guide track system at sidelites, **as directed**.
   d. Finish: Finish framing, door(s), sidelite(s), and header with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder-coat finish **OR** high-performance organic finish (two-coat fluoropolymer) **OR** metal cladding, **as directed**.
      1) Color: Light bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
      2) Metal Cladding: No. 4, directional-satin-finish stainless steel **OR** No. 8, mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Manufacturer's standard satin brass **OR** Manufacturer's standard polished brass **OR** Manufacturer's standard satin bronze, **as directed**.

C. Components
1. Framing and Transom Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.
   a. Nominal Size: 1-3/4 by 4-1/2 inches (45 by 115 mm) **OR** 1-3/4 by 6 inches (45 by 150 mm) **OR** As indicated on Drawings, **as directed**.
   b. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.
2. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- (45-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.
   a. Glazing Stops and Gaskets: Beveled **OR** Square, **as directed**, snap-on, extruded-aluminum stops and preformed gaskets for glazing indicated.
   b. Stile Design: Narrow stile; 2-1/8-inch (55-mm) nominal width **OR** Medium stile; 3-1/2-inch (90-mm) nominal width **OR** Wide stile; more than 4-inch (100-mm) nominal width **OR** As indicated on Drawings, **as directed**.
   c. Rail Design: 3-1/2-inch (90-mm) nominal height **OR** 5-inch (125-mm) nominal height **OR** As indicated on Drawings, **as directed**.
   d. Muntin Bars: Horizontal tubular rail member for each door; match stile design.

3. Sidelites: Manufacturer's standard 1-3/4-inch- (45-mm-) deep sidelites with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design and finish.
   a. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
   b. Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.
4. Glazing: As specified in Division 08 Section "Glazing".
5. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick extruded aluminum, and extending full width of ICU/CCU entrance units to conceal carrier assemblies and roller tracks. Provide hinged or removable access panels for service and adjustment. Secure panels to prevent unauthorized access.
   a. Capacity: Capable of supporting doors up to 100 lb (45 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.
   b. Provide sag rods for spans exceeding 14 feet (4.3 m).
6. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly. Provide minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
7. Concealed Bottom Rollers: Manufacturer's standard.
8. Brackets and Reinforcements: Manufacturer's standard, high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
9. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

D. Hardware
1. General: Provide units in sizes and types recommended by ICU/CCU entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
2. Breakaway Hardware: Provide release hardware that allows indicated panels to swing out in direction of egress to full 90 degrees from sliding mode.
   a. Maximum Force to Open Panel: 50 lbf (222 N).
   b. Release Position: Sliding door fully open **OR** At any point in sliding door travel, **as directed**.
3. Limit Arm: Provide to control doors in the swing mode.
4. Pulls: Manufacturer's standard recessed units on both sides of each operable door and surface-mounted, D-shaped pull for each swing-out sidelite.
5. Manual Flush Bolts: BHMA A156.16, Grade 1, edge mortised, lever-extension type; located at bottom of each swing-out sidelite.
6. Deadlocks: Manufacturer's standard, operated by exterior cylinder and interior thumb turn.
   a. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
   b. Cylinders: BHMA A156.5, Grade 1, six-pin mortise type **OR** As specified in Division 08 Section "Door Hardware", **as directed**.
      1) Keying: No master **OR** Integrate into building master, **as directed**, key system, and key all cylinders alike, **as directed**.
      2) Keys: Two **OR** Three, **as directed**, for each cylinder.
7. Weather Stripping: Manufacturer's standard replaceable components.
   a. Compression Type: ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
   b. Sliding Type: AAMA 701, wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
8. Weather Sweeps: Manufacturer's standard, nylon brush sweep mounted to underside of door bottom.

E. Fabrication
1. General: Factory fabricate ICU/CCU entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

a. Fabricate aluminum components before finishing.
b. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
c. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing **OR** fabricated from stainless steel, **as directed**.
   1) Where fasteners are subject to loosening or turning out from structural movements or vibration, use self-locking devices.
   2) Reinforce members as required to receive fastener threads.
d. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

2. Framing: Provide ICU/CCU entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
   a. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
   b. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
   c. Form profiles that are straight and free of defects or deformations.
   d. Provide components with concealed fasteners and anchor and connection devices.
   e. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
   f. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
3. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
4. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
5. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
   a. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors and breakaway sidelites.
6. Electrical Grounding: Fabricate ICU/CCU entrances to be internally grounded, complying with requirements of authorities having jurisdiction.

F. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

G. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.
4. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF

resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1.3 EXECUTION

A. Installation
1. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
2. Install ICU/CCU entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
a. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
b. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
c. Level recesses for recessed floor tracks using shrinkage-resistant grout.
3. Glazing: Install glazing as specified in Division 08 Section "Glazing".
4. Sealants: Comply with requirements in Division 07 Section "Joint Sealants" for installing sealants, fillers, and gaskets.
a. Set framing members, floor tracks, and flashings in full sealant bed.
b. Seal perimeter of framing members with sealant.
5. Grounding: Connect ICU/CCU-entrance, electrical grounding systems to building grounding system as specified in Division 26 Section "Grounding And Bonding For Electrical Systems".

B. Adjusting
1. Adjust operating hardware and moving parts for smooth and safe operation; lubricate as recommended by manufacturer.
2. Adjust force to open swing panels.
3. Test grounding system for compliance with requirements of authorities having jurisdiction.

C. Cleaning And Protection
1. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
2. Comply with requirements in Division 08 Section "Glazing" for cleaning and protecting glass.

END OF SECTION 08 42 29 23

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Task	Specification	Specification Description
08 42 29 23	08 32 13 00	Sliding Aluminum-Framed Glass Doors

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SECTION 08 42 33 00 - REVOLVING ENTRANCE DOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for revolving entrance doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Manual revolving door entrances.
b. Automatic revolving door entrances.
c. Access-control revolving door entrances.

C. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for revolving door entrances.
2. Shop Drawings: For revolving door entrances. Include plans, elevations, sections, details, and attachments to other work. Indicate enclosures, speed-control units, and other components not in manufacturer's product data.
a. Wiring Diagrams: Power, signal, and control wiring.
3. Samples:
a. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (76 by 127 mm).
b. Glass Samples: For each type of tinted glass; 12 inches (300 mm) square.
4. Qualification Data: For qualified Installer, manufacturer and testing agency.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for revolving door entrances.
6. Operation and Maintenance Data: For revolving door entrances to include in operation and maintenance manuals.
7. Warranties: Samples of special warranties.

D. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Regulatory Requirements: Wings shall be capable of collapsing into a book-fold position to provide minimum aggregate parallel width of 36 inches (914 mm) when breakaway force of no more than 130 lbf (572N) **OR** 180 lbf (801N), **as directed**, is applied within 3 inches (76 mm) of outer edges. Set maximum turning speed to comply with requirements of authorities having jurisdiction.
3. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
a. Safety-Glass Labeling: Where safety-glass labeling is indicated, permanently mark glass with certification label of the SGCC, another certification agency acceptable to authorities having jurisdiction, or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety-glass standard with which glass complies.
4. Revolving Door Entrance Standard: BHMA A156.27.
5. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver revolving door entrance glass, decorative metalwork, and other exposed elements in padded blankets or other approved protective wrapping.

2. Protect finish surfaces from damage during handling and installation.

F. Coordination
1. Recesses: Coordinate size and location of recesses in floor construction for recessed, floor-mounted speed-control units, pivot bearings, foot grilles and recessed mats including anchorages for frames and supports. Furnish setting drawings, templates, and directions for installing anchorages that are to be embedded into concrete. Deliver these items to Project site in time for installation. Concrete, reinforcement, and formwork requirements are specified in Division 31.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of revolving door entrances that fail in materials or workmanship within specified warranty period.
a. Failures include, but are not limited to, the following:
1) Lateral deflection of glass lite edges in excess of 1/175 of their length or 3/4 inch (19 mm), whichever is less.
2) Excessive air leakage.
3) Faulty operation of speed-control unit and hardware.
4) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
b. Warranty Period for Revolving Door Entrances: Three years from date of Final Completion.
c. Warranty Period for Speed-Control Units: Five years from date of Final Completion.
d. Warranty Period for Finishes: 20 years from date of Final Completion.

1.2 PRODUCTS

A. Revolving Door Entrances
1. Air Infiltration: Maximum air leakage of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of wing area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa), [equivalent to a 25-mph (40-km/h) wind].
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
3. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic **OR** enhanced, **as directed**,-protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested using the large-missile test according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
4. Seismic Performance: Revolving door entrances shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

B. Manual Revolving Door Entrances
1. Description: Provide manufacturer's standard two-wing **OR** three-wing **OR** four-wing, **as directed**, manual revolving door entrance, complete with center shaft, speed-control unit, wings, enclosure walls, canopy, hardware, glass and glazing, and accessories as indicated.
a. Manual Speed-Control Unit: Mechanical speed regulator that allows free rotation of wings up to a predetermined rate of speed and that engages a clutch-type brake to prevent rapid acceleration of wings.
1) Location: Recessed, floor mounted **OR** Overhead, **as directed**.

2) Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.

b. Stile-and-Rail Wings: Manufacturer's standard with 1-3/4-inch- (45-mm-) thick tubular stile-and-rail members.
1) Stile Design: Narrow stile, 2-inch (51-mm) nominal width **OR** Medium stile, 3-1/2-inch (89-mm) nominal width **OR** Wide stile, 5-inch (127-mm) nominal width **OR** As indicated on Drawings, **as directed**.
2) Rail Design: 3-inch (76-mm) nominal height **OR** 4-inch (102-mm) nominal height **OR** As indicated on Drawings, **as directed**.
3) Muntin Design: To match stile design.
4) Glass: Clear, fully tempered float glass.
a) Thickness: 6 mm **OR** 8 mm **OR** 10 mm, **as directed**.

c. All-Glass Wings: Manufacturer's standard all-glass wings with tubular metal top and bottom rail members.
1) Glass: Clear, fully tempered float glass.
a) Thickness: 12 mm.

d. Push Bars: Manufacturer's standard push bars, finished to match wings.
1) Shape: Round bars, 1 inch (25 mm) in diameter **OR** Flat bars, 1/2 inch thick and 1-1/2 inches (13 mm thick and 38 mm) high **OR** Manufacturer's standard, **as directed**.

e. Locks: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each revolving door entrance.
1) Cylinders: Comply with requirements in Division 08 Section "Door Hardware".
2) Mounting: Surface applied **OR** Mortised, **as directed**.
3) Location: Extend bolt from bottom of wing into floor **OR** top of wing into ceiling **OR** bottom of wing into base of wall enclosure, **as directed**.

f. Enclosure Walls: Manufacturer's standard, with 1-3/4-inch- (45-mm-) thick tubular framing members.
1) Configuration: Curved **OR** Segmented, **as directed**.
2) Glass: Clear **OR** Tinted, **as directed**, fully tempered float glass.
a) Thickness: 6 mm **OR** 8 mm, **as directed**.
b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
3) Glass: Clear **OR** Tinted, **as directed**, laminated glass with two plies of float glass separated by an interlayer.
a) Thickness: Two 3-mm-thick lites **OR** Two 5-mm-thick lites **OR** Two 6-mm-thick lites **OR** Two 8-mm-thick lites **OR** As indicated, **as directed**.
b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
4) Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.

g. Canopy: Manufacturer's standard ceiling, fascia, roof, **as directed**, and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.
1) Metal-Clad Plywood: Fabricate from 3/4-inch- (19-mm-) thick plywood clad with metal sheet. Provide ceiling access panels for repairs to or maintenance of speed-control unit.
OR
Metal: Fabricate from minimum 0.125-inch- (3.18-mm-) thick, aluminum sheet. Provide ceiling access panels for repairs to or maintenance of speed-control unit.
OR
Glass: Clear **OR** Tinted, **as directed**, laminated glass ceiling with two plies of float glass separated by an interlayer.
a) Thickness: Two 6-mm-thick lites **OR** 6-mm-thick top lite and 12-mm-thick bottom lite **OR** As indicated, **as directed**.
b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.

2) Ceiling Lights: Manufacturer's standard, consisting of two recessed light fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
3) Canopy Roof: Manufacturer's standard, of material and finish matching enclosure walls where visible.

h. Floors: Extend adjacent flooring material specified in a Division 07 into enclosure as indicated on Drawings.
1) Recessed Grilles: Provide grille at entry segment only. Fabricate, using welded joints, from minimum 1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall), concentrically curved metal bar stock with 1/4-inch (6-mm) spacing. Finish to match wings.

2. Materials: Extruded aluminum **OR** Stainless-steel-clad, extruded aluminum **OR** Copper-alloy-clad, extruded aluminum, **as directed**.
a. Main Extrusions and Tubing: Minimum wall thickness of 0.125 inch (3.2 mm).
b. Cladding: Minimum 0.04 inch (1.0 mm) thick.

3. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion. Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
a. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
1) Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Division 08 Section "Glazing". Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
2) Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
3) Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
OR
Mechanically Joined Construction: Joints shall be tightly bolted together. Glass stops shall be snap-in type where possible.
OR
Mechanically Joined Clad Construction: Joints shall be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops shall be snap-in type where possible.
b. Enclosure Walls and Canopy: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, according to manufacturer's standards and as specified. Provide subframes as required for a complete system to support required loads.
1) Exterior Framing: Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.

4. Aluminum Finishes: Clear anodic **OR** Color anodic **OR** Baked enamel or powder coat **OR** High performance, organic, **as directed**.
a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

5. Stainless-Steel Finishes: No. 4 **OR** No. 7 **OR** No. 8, **as directed**.

6. Copper-Alloy Finishes: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Medium-satin finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.

C. Automatic Revolving Door Entrances

1. Description: Provide manufacturer's standard two-wing **OR** three-wing **OR** four-wing, **as directed**, automatic revolving door entrance, complete with center shaft **OR** core **OR** core with rotating glazed display case, **as directed**, speed-control unit, wings, enclosure walls, canopy, hardware, glass and glazing, activation devices, safety devices, and accessories as indicated.

a. Powered Speed-Control Unit: Provide an electric or electrohydraulic speed regulator to permit automatic rotation of wings. Unit shall allow for manual operation when power is off. Furnish power-operation equipment to suit current characteristics of building electrical service.

1) Location: Recessed, floor mounted **OR** Overhead, **as directed**.

2) Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.

b. Manual-Push Activation: Pushing wing activates unit and maintains rotation of wings for manufacturer's standard preset time.

OR

Continuous Operation: Wings revolve continuously.

OR

Signal Activation: Signal from activation device begins and maintains rotation of wings for manufacturer's standard preset time.

1) Motion Detectors: Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; to provide adjustable detection-field sizes, patterns, and functions required by BHMA A156.10. Mount centered on both sides of canopy fascia.

2) Presence Detectors: Self-contained, infrared-scanner units with metal or plastic housing; to provide adjustable detection-field sizes, patterns, and functions required by BHMA A156.10. Detectors shall remain active at all times. Mount recessed in canopy ceiling **OR** on each wing, **as directed**.

3) Combination Motion-Presence Detectors: Self-contained, one-piece units consisting of both motion and presence detectors in a single metal or plastic housing adjustable to provide detection-field sizes, patterns, and functions required by BHMA A156.10. Mount on both sides of canopy fascia.

4) Photoelectric Beams: Pulsed infrared, sender-receiver assembly recessed in canopy ceiling **OR** on each wing, **as directed**.

5) Control Mats: 1/2-inch- (13-mm-) thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and complying with performance requirements in BHMA A156.10 including Appendix A.

a) Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.

b) Frame: Recessed to fit flush with floor; with concealed anchors **OR** Surface mounted; with tapered safety edge, **as directed**.

6) Push-Plate Switch: Momentary-contact control switch with flat stainless-steel push plate engraved with message "Push to Open" **OR** plastic push-plate engraved with message "Push to Open" in contrasting color, **as directed**.

a) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.

7) Push-Button Switch: Momentary-contact control switch with one red-button actuator. Provide blue plastic cover engraved with message "Press to Open" in white letters.

a) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.

8) Key Switch: Recess-mounted control switch with key-controlled actuator and enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with letters indicating switch functions.
   a) Functions: On-off **OR** On-off, momentary contact, **as directed**.
   b) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.

c. Stile-and-Rail Wings: Manufacturer's standard with 1-3/4-inch- (45-mm-) thick tubular stile-and-rail members.
   1) Stile Design: Narrow stile, 2-inch (51-mm) nominal width **OR** Medium stile, 3-1/2-inch (89-mm) nominal width **OR** Wide stile, 5-inch (127-mm) nominal width **OR** As indicated on Drawings, **as directed**.
   2) Rail Design: 3-inch (76-mm) nominal height **OR** 4-inch (102-mm) nominal height **OR** As indicated on Drawings, **as directed**.
   3) Muntin Design: To match stile design.
   4) Glass: Clear, fully tempered float glass.
      a) Thickness: 6 mm **OR** 8 mm **OR** 10 mm, **as directed**.

d. All-Glass Wings: Manufacturer's standard all-glass wings with tubular metal top and bottom rail members.
   1) Glass: Clear, fully tempered float glass.
      a) Thickness: 12 mm.

e. Push Bars: Manufacturer's standard push bars, finished to match wings.
   1) Shape: Round bars, 1 inch (25 mm) in diameter **OR** Flat bars, 1/2 inch thick and 1-1/2 inches (13 mm thick and 38 mm) high **OR** Manufacturer's standard, **as directed**.

f. Locks: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each revolving door entrance.
   1) Cylinders: Comply with requirements in Division 08 Section "Door Hardware".
   2) Mounting: Surface applied **OR** Mortised, **as directed**.
   3) Location: Extend bolt from bottom of wing into floor **OR** top of wing into ceiling **OR** bottom of wing into base of wall enclosure, **as directed**.

g. Enclosure Walls: Manufacturer's standard, with 1-3/4-inch- (45-mm-) thick tubular framing members.
   1) Configuration: Curved **OR** Segmented, **as directed**.
   2) Glass: Clear **OR** Tinted, **as directed**, fully tempered float glass.
      a) Thickness: 6 mm **OR** 8 mm, **as directed**.
      b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.

      OR

      Glass: Clear **OR** Tinted, **as directed**, laminated glass with two plies of float glass separated by an interlayer.
      a) Thickness: Two 3-mm-thick lites **OR** Two 5-mm-thick lites **OR** Two 6-mm-thick lites **OR** Two 8-mm-thick lites **OR** As indicated, **as directed**.
      b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
   3) Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.

h. Canopy: Manufacturer's standard ceiling, fascia, roof, **as directed**, and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.
   1) Metal-Clad Plywood: Fabricate from 3/4-inch- (19-mm-) thick plywood clad with metal sheet. Provide ceiling access panels for repairs to or maintenance of speed-control units.
   2) Metal: Fabricate from minimum 0.125-inch- (3.18-mm-) thick, aluminum sheet. Provide ceiling access panels for repairs to or maintenance of speed-control units.
   3) Glass: Clear **OR** Tinted, **as directed**, laminated glass ceiling with two plies of float glass separated by an interlayer.

a) Thickness: Two 6-mm-thick lites **OR** 6-mm-thick top lite and 12-mm-thick bottom lite **OR** As indicated, **as directed**.
b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.

4) Ceiling Lights: Manufacturer's standard, consisting of two recessed light fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
5) Canopy Roof: Manufacturer's standard, of material and finish matching enclosure walls where visible.

i. Floors: Extend adjacent flooring material specified in a Division 07 into enclosure as indicated on Drawings.
1) Recessed Grilles: Provide grille at entry quadrant only. Fabricate, using welded joints, from minimum 1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall), concentrically curved metal bar stock with 1/4-inch (6-mm) spacing. Finish to match wings.

j. Rotating Glazed Display Case: Glazed enclosure incorporated into core, with framing matching wings and with panel on one side for access to display area.

k. Safety Devices: Manufacturer's standard safety devices as required to stop or slow rotation. Provide the following:
1) Emergency Stop Button: Momentary contact, red push-button switch to immediately stop wing rotation and reverse direction to entry position, **as directed**. Provide sign indicating "Emergency Stop."
a) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.
2) Slow-Speed Operation Button: Momentary contact push-button switch or plate to slow wing rotation by reducing rpm by one half. Include sign indicating operation.
a) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.
3) Vertical Safety Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch plate encapsulated in a flexible housing. Mount on enclosure walls at vertical edge of entry.
4) Horizontal Safety Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch plate encapsulated in a flexible housing. Mount at bottom edge of each wing.

2. Materials: Extruded aluminum **OR** Stainless-steel-clad, extruded aluminum **OR** Copper-alloy-clad, extruded aluminum, **as directed**.
a. Main Extrusions and Tubing: Minimum wall thickness of 0.125 inch (3.2 mm).
b. Cladding: Minimum 0.04 inch (1.0 mm) thick.

3. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion. Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
a. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
1) Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Division 08 Section "Glazing". Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
2) Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
3) Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
OR

Mechanically Joined Construction: Joints shall be tightly bolted together. Glass stops shall be snap-in type where possible.
OR
Mechanically Joined Clad Construction: Joints shall be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops shall be snap-in type where possible.

b. Enclosure Walls and Ceilings: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, according to manufacturer's standards and as specified. Provide subframes as required for a complete system to support required loads.
   1) Exterior Framing: Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.

4. Aluminum Finishes: Clear anodic **OR** Color anodic **OR** Baked enamel or powder coat **OR** High performance, organic, **as directed**.
   a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Stainless-Steel Finishes: No. 4 **OR** No. 7 **OR** No. 8, **as directed**.
6. Copper-Alloy Finishes: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Medium-satin finish, lacquered **OR** Statuary conversion coating over satin finish **as directed**.

D. Access-Control Revolving Door Entrances
1. Description: Provide manufacturer's standard four-wing **OR** three-wing, **as directed**, access-control revolving door entrance, complete with center shaft **OR** core, **as directed**, speed-control unit, wings, enclosure walls, canopy, hardware, glass and glazing, activation devices, safety devices, and accessories as indicated.
   a. Powered Speed-Control Unit: Provide an electric or electrohydraulic speed regulator to permit automatic rotation of wings. Unit shall allow for manual operation when power is off. Furnish power-operation equipment to suit current characteristics of building electrical service.
      1) Location: Recessed, floor mounted **OR** Overhead, **as directed**.
      2) Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.
   b. Activation Devices: Keypads **OR** Card readers **OR** Biometric identity verification equipment, **s directed**, as specified in Division 28 Section "Access Control".
      1) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.
   c. Stile-and-Rail Wings: Manufacturer's standard with 1-3/4-inch- (45-mm-) thick tubular stile-and-rail members.
      1) Stile Design: Narrow stile, 2-inch (51-mm) nominal width **OR** Medium stile, 3-1/2-inch (89-mm) nominal width **OR** Wide stile, 5-inch (127-mm) nominal width **OR** As indicated on Drawings, **as directed**.
      2) Rail Design: 3-inch (76-mm) nominal height **OR** 4-inch (102-mm) nominal height **OR** As indicated on Drawings, **as directed**.
      3) Muntin Design: To match stile design.
      4) Glass: Clear, fully tempered float glass.
         a) Thickness: 6 mm **OR** 8 mm **OR** 10 mm, **as directed**.
   d. Locks: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each revolving door entrance.
      1) Cylinders: Comply with requirements in Division 08 Section "Door Hardware".
      2) Mounting: Surface applied **OR** Mortised, **as directed**.

3) Location: Extend bolt from bottom of wing into floor **OR** top of wing into ceiling **OR** bottom of wing into base of wall enclosure, **as directed**.

e. Enclosure Walls: Manufacturer's standard, with 1-3/4-inch- (45-mm-) thick tubular framing members.
1) Configuration: Curved **OR** Segmented.
2) Glass: Clear **OR** Tinted, **as directed**, fully tempered float glass.
a) Thickness: 6 mm **OR** 8 mm, **as directed**.
b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
OR
Glass: Clear **OR** Tinted, **as directed**, laminated glass with two plies of float glass separated by an interlayer.
a) Thickness: Two 3-mm-thick lites **OR** Two 5-mm-thick lites **OR** Two 6-mm-thick lites **OR** Two 8-mm-thick lites **OR** As indicated, **as directed**.
b) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
3) Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.

f. Canopy: Manufacturer's standard ceiling, fascia, roof, **as directed**, and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.
1) Metal-Clad Plywood: Fabricate from 3/4-inch- (19-mm-) thick plywood clad with metal sheet. Provide ceiling access panels for repairs to or maintenance of speed-control units.
2) Metal: Fabricate from minimum 0.125-inch- (3.18-mm-) thick, aluminum sheet. Provide ceiling access panels for repairs to or maintenance of speed-control units.
3) Ceiling Lights: Manufacturer's standard, consisting of two recessed light fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
4) Canopy Roof: Manufacturer's standard, of material and finish matching enclosure walls where visible.

g. Floors: Extend adjacent flooring material specified in a Division 07 into enclosure as indicated on Drawings.
1) Recessed Grilles: Provide grille at entry quadrant only. Fabricate, using welded joints, from minimum 1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall), concentrically curved metal bar stock with 1/4-inch (6-mm) spacing. Finish to match wings.

h. Safety Devices: Manufacturer's standard safety devices as required to stop or slow rotation. Provide the following:
1) Emergency Stop Button: Momentary contact, red push-button switch to immediately stop wing rotation and reverse direction to entry position, **as directed**. Provide sign indicating "Emergency Stop."
a) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **as directed**, on right-hand side of opening.
2) Slow-Speed Operation Button: Momentary contact push-button switch or plate to slow wing rotation by reducing rpm by one half. Include sign indicating operation.
a) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** Surface mounted on bollard **OR** As indicated on Drawings, **asdirected**, on right-hand side of opening.
3) Vertical Safety Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch plate encapsulated in a flexible housing. Mount on enclosure walls at vertical edge of entry.
4) Horizontal Safety Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch plate encapsulated in a flexible housing. Mount at bottom edge of each wing.

2. Materials: Extruded aluminum **OR** Stainless-steel-clad, extruded aluminum **OR** Copper-alloy-clad, extruded aluminum, **as directed**.

a. Main Extrusions and Tubing: Minimum wall thickness of 0.125 inch (3.2 mm).
b. Cladding: Minimum 0.04 inch (1.0 mm) thick.

3. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion. Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
   a. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
      1) Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Division 08 Section "Glazing". Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
      2) Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
      3) Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
         OR
         Mechanically Joined Construction: Joints shall be tightly bolted together. Glass stops shall be snap-in type where possible.
         OR
         Mechanically Joined Clad Construction: Joints shall be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops shall be snap-in type where possible.
   b. Enclosure Walls and Ceilings: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, according to manufacturer's standards and as specified. Provide subframes as required for a complete system to support required loads.
      1) Exterior Framing: Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.
4. Aluminum Finishes: Clear anodic **OR** Color anodic **OR** Baked enamel or powder coat **OR** High performance, organic, **as directed**.
   a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Stainless-Steel Finishes: No. 4 **OR** No. 7 **OR** No. 8, **as directed**.
6. Copper-Alloy Finishes: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Medium-satin finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.

E. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   b. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304 **OR** Type 316, **as directed**.
3. Plate, Sheet, Strip, and Bars; Bronze: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).
4. Steel: ASTM A 36/A 36M plate, shapes, and bars; or ASTM A 1008/A 1008M sheet.
5. Fasteners: Manufacturer's standard, of same basic metal as fastened metal, unless otherwise indicated.
6. Glazing Materials: Comply with requirements in Division 08 Section "Glazing".
7. Weather Stripping: Heavy-duty, single-piece rubber or combination of rubber and felt.

8. Nonshrink, Nonmetallic Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; of consistency suitable for application.
9. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
10. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.

F. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Finish revolving door entrance components to match adjacent curtain wall or storefront.

G. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
4. High-Performance Organic Finish: Two-coat **OR** Three-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

H. Stainless-Steel Finishes
1. General: Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
2. Directional Satin Finish: No. 4.
3. Reflective, Directional Polish: No. 7.
4. Mirrorlike Reflective, Nondirectional Polish: No. 8.
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

I. Copper-Alloy Finishes
1. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
2. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
   a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
3. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
   a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
4. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).
   a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

5. Statuary Conversion Coating over Satin Finish: M31-C55-O6x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air drying, as specified below), with color matching the Owner's sample.
   a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

1.3 EXECUTION

A. Examination
1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
   a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
   b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with corrosion-resistant coatings.
2. Recessed, Floor-Mounted Speed-Control Unit: Insert control unit in rough-in floor opening set on level bed of nonshrink, nonmetallic grout. Fill annular space between control unit and sides of recess with nonshrink, nonmetallic grout. Mix and place grout to comply with grout manufacturer's written instructions.
   a. Connect speed-control unit to electrical power distribution system as specified in Division 22.

   OR

   Overhead-Mounted Speed-Control Unit: Insert pivot bearing in rough-in floor opening set on level bed of nonshrink, nonmetallic grout. Fill annular space between pivot bearing and sides of recess with nonshrink, nonmetallic grout. Mix and place grout to comply with grout manufacturer's written instructions.
   b. Connect speed-control unit to electrical power distribution system as specified in Division 22.
3. Install revolving door entrances according to manufacturer's written instructions, plumb and true, without warp or rack of framing members and wings. Anchor securely in place.
   a. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
   b. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the assembly to exterior.
   c. Cut and trim framing during installation only with approval of manufacturer.
      1) Restore finish and remove and replace members, as directed, where cutting and trimming have impaired strength or appearance.
      2) Do not install members that are warped, bowed, deformed, or otherwise damaged or defaced to such an extent as to impair strength or appearance. Remove and replace members that have been damaged during installation.
4. Activation and Safety Devices: Adjust devices to provide detection field and functions indicated.
5. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide weathertight installation.
   a. Set continuous sill members and flashings in full sealant bed.
   b. Seal perimeter of framing members with sealant.

C. Adjusting

1. Adjust wings to provide an even, tight fit at contact points and weather stripping for smooth operation and weathertight closure. Adjust wings to operate smoothly and rotate evenly, with hardware and operators functioning properly.
   a. Lubricate operating hardware and other moving parts.
   b. Adjust speed-control unit for specified rpm.
   c. Adjust pressure for collapse of wings for specified breakaway force.
2. Readjust wings and speed-control units after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles). Lubricate hardware and other moving parts.

D. Cleaning And Protection
1. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
2. Limit construction traffic during remainder of construction period.

E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain revolving door entrances.

END OF SECTION 08 42 33 00

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Task	Specification	Specification Description
08 42 36 00	08 05 13 00	Steel Doors And Frames
08 42 36 00	08 12 13 13a	Stainless Steel Doors And Frames
08 43 13 00	08 42 13 00	Aluminum-Framed Entrances And Storefronts
08 43 19 00	01 22 16 00	No Specification Required

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SECTION 08 44 13 00 - GLAZED ALUMINUM CURTAIN WALLS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for glazed aluminum curtain walls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes conventionally glazed aluminum curtain walls installed as stick, unitized, and unit-and-mullion assemblies.

C. Performance Requirements
1. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   a. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings **OR as directed,** including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   b. Failure also includes the following:
      1) Thermal stresses transferring to building structure.
      2) Glass breakage.
      3) Noise or vibration created by wind and thermal and structural movements.
      4) Loosening or weakening of fasteners, attachments, and other components.
      5) Failure of operating units.
2. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Loads:
   a. Wind Loads: As indicated on Drawings **OR as directed**.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
      2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
   b. Blast Loads: As indicated on Drawings **OR as directed**.
   c. Periodic Maintenance-Equipment Loads: As indicated on Drawings **OR as directed**.
4. Structural-Test Performance: Test according to ASTM E 330 as follows:
   a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity, but not less than 10 seconds.
5. Deflection of Framing Members: At design wind pressure, as follows:
   a. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite **OR** 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m), **as directed**, or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.

b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.
   1) Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

c. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

6. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 **OR** Zone 2 **OR** Zone 3 **OR** Zone 4, **as directed**.
   a. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
   b. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
7. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
8. Story Drift: Accommodate design displacement of adjacent stories indicated.
   a. Design Displacement: As indicated on Drawings **OR as directed**.
   b. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement, **as directed**.
9. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
10. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
    a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
11. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
    a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
    b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
    c. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
12. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
    a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) **OR** 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, as determined according to NFRC 100.
    b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 **OR** 0.40 **OR** 0.45, **as directed**, as determined according to NFRC 200.
    c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.

d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC- certified condensation resistance rating of no less than 15 **OR** 25 **OR** 35 **OR** 45, **as directed**, as determined according to NFRC 500.

13. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
    a. Outdoor-Indoor Transmission Class: Minimum 26 **OR** 30 **OR** 34, **as directed**, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

D. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. LEED Submittal:
    a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
    a. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
    b. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
        1) Joinery, including concealed welds.
        2) Anchorage.
        3) Expansion provisions.
        4) Glazing.
        5) Flashing and drainage.
4. Samples: For each type of exposed finish required.
5. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified Installer and testing agency, **as directed**.
7. Seismic Qualification Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Welding certificates.
9. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
    a. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
10. Product test reports.
11. Field quality-control reports.
12. Maintenance data.
13. Warranties: Sample of special warranties.

E. Quality Assurance
1. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
2. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
4. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

5. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
6. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   a. Provide NFRC-certified glazed aluminum curtain walls with an attached label.
7. Preinstallation Conference: Conduct conference at Project site.

F. Warranty
1. Special Assembly Warranty: Standard form in which manufacturer **OR** Installer, **as directed**, agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
   d. Structural Profiles: ASTM B 308/B 308M.
   e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

B. Framing
1. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   a. Construction: Nonthermal **OR** Thermally improved **OR** Thermally broken, **as directed**.
   b. Glazing System: Retained mechanically with gaskets on four sides.
   c. Glazing Plane: Front.
2. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   b. Reinforce members as required to receive fastener threads.
   c. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system **OR** fabricated from 300 series stainless steel, **as directed**.
4. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

a. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

5. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer, **as directed**.
6. Framing Sealants: Manufacturer's standard sealants.

C. Glazing
1. Glazing: Comply with Division 08 Section "Glazing".
2. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers **OR** Comply with Division 08 Section "Glazing", **as directed**.
3. Glazing Sealants: As recommended by manufacturer **OR** Comply with Division 08 Section "Glazing", **as directed**.
   a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Insulated Spandrel Panels
1. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
   a. Overall Panel Thickness: As indicated **OR** 1 inch (25.4 mm), **as directed**.
   b. Exterior Skin: Aluminum.
      1) Thickness: Manufacturer's standard for finish and texture indicated.
      2) Finish: Matching framing system.
      3) Texture: Smooth **OR** Embossed, **as directed**.
      4) Backing Sheet: 1/8-inch- (3.2-mm-) thick, tempered hardboard **OR** 0.157-inch- (4-mm-) thick, cement board **OR** 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene, **as directed**.
   c. Interior Skin: Aluminum **OR** Manufacturer's standard galvanized-steel sheet, **as directed**.
      1) Thickness: Manufacturer's standard for finish and texture indicated.
      2) Finish: Matching curtain-wall framing **OR** Low-gloss, white baked enamel **OR** Mill finish, **as directed**.
      3) Texture: Smooth **OR** Embossed, **as directed**.
      4) Backing Sheet: 1/8-inch- (3.2-mm-) thick, tempered hardboard **OR** 0.157-inch- (4-mm-) thick, cement board **OR** 1/2-inch- (12.7-mm-) thick, gypsum board with proprietary fire-resistance-rated core **OR** 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene, **as directed**.
   d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board **OR** extruded-polystyrene board **OR** expanded-perlite, mineral-insulation board, **as directed**.
   e. Surface-Burning Characteristics: For exposed interior surfaces of panels, when tested according to ASTM E 84 as follows:
      1) Flame-Spread Index: 25 or less.
      2) Smoke-Developed Index: 450 or less.

E. Operable Units
1. Venting Windows: Comply with Division 08 Section "Aluminum Windows".
2. Doors: Comply with Division 08 Section "Aluminum-framed Entrances And Storefronts".

F. Accessory Materials
1. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

G. Fabrication
1. Form or extrude aluminum shapes before finishing.

2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Fabricate components that, when assembled, have the following characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Physical and thermal isolation of glazing from framing members.
   d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   e. Provisions for field replacement of glazing from exterior **OR** interior **OR** interior for vision glass and exterior for spandrel glazing or metal panels, **as directed**.
   f. Provisions for safety railings mounted on interior face of mullions **OR** between mullions at interior, **as directed**.
   g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   h. Components curved to indicated radii.
4. Fabricate components that, when assembled, have the following characteristics:
   a. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   b. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
5. Curtain-Wall Framing: Fabricate components for assembly using shear-block system **OR** screw-spline system **OR** head-and-sill-receptor system with shear blocks at intermediate horizontal members, **as directed**.
6. Factory-Assembled Frame Units:
   a. Rigidly secure nonmovement joints.
   b. Seal joints watertight unless otherwise indicated.
   c. Install glazing to comply with requirements in Division 08 Section "Glazing".
7. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

H. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, a**s directed**, or thicker.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish:
   a. Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      OR

      Three-coat **OR** Four-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

OR
Two-coat fluoropolymer finish complying with AAMA 2604 and containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

b. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation
1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmovement joints.
   e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   g. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
   a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
   b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
4. Install components plumb and true in alignment with established lines and grades.
5. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
6. Install glazing as specified in Division 08 Section "Glazing".

B. Erection Tolerances
1. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
   a. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
   b. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
   c. Alignment:
      1) Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      2) Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      3) Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
   d. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
   a. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft.

(2.25 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.

1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.

   OR

   Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.

b. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.

1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.

   OR

   Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.

c. Water Spray Test: Before installation of interior finishes has begun, areas designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.

1) Test Area: A minimum area of 75 feet (23 m) by one story of glazed aluminum curtain wall.

3. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 08 44 13 00

SECTION 08 44 13 00a - STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for structural-sealant-glazed curtain walls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
   a. Factory-glazed **OR** Field-glazed, **as directed**, two-sided structural-sealant-glazed curtain-wall assemblies.
   b. Factory-glazed, four-sided structural-sealant-glazed curtain-wall assemblies.

C. Performance Requirements

1. General Performance: Comply with performance requirements specified, as determined by testing manufacturer's standard of structural-sealant-glazed curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   a. Structural-sealant-glazed curtain walls shall withstand movements of supporting structure indicated on Drawings, **OR as directed**, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   b. Failure also includes the following:
      1) Thermal stresses transferring to building structure.
      2) Glass breakage.
      3) Noise or vibration created by wind and thermal and structural movements.
      4) Loosening or weakening of fasteners, attachments, and other components.
      5) Failure of operating units.
2. Delegated Design: Design structural-sealant-glazed curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Loads:
   a. Wind Loads: As indicated on Drawings **OR as directed**.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
      2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
   b. Blast Loads: As indicated on Drawings **OR as directed**.
   c. Periodic Maintenance-Equipment Loads: As indicated on Drawings **OR as directed**.
4. Structural-Test Performance: Provide structural-sealant-glazed curtain walls tested according to ASTM E 330 as follows:
   a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity, but not less than 10 seconds.
5. Deflection of Framing Members: At design wind pressure, as follows:
   a. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite **OR** 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m), **as directed**, or an

amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.

b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.

1) Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

c. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175.

6. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 **OR** Zone 2 **OR** Zone 3 **OR** Zone 4, **as directed**.
   a. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
   b. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
7. Seismic Performance: Structural-sealant-glazed curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
8. Story Drift: Accommodate design displacement of adjacent stories indicated.
   a. Design Displacement: As indicated on Drawings **OR as directed**.
   b. Test Performance: Meets criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement, **as directed**.
9. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
10. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
    a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
11. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
    a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
    b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
    c. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.
12. Energy Performance: Structural-sealant-glazed curtain walls shall have certified and labeled energy performance ratings according to NFRC.
    a. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) **OR** 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, as determined according to NFRC 100.
    b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a SHGC of no greater than 0.35 **OR** 0.40 **OR** 0.45, **as directed**, as determined according to NFRC 200.
    c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283

at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.

d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified CR rating of no less than 15 **OR** 25 **OR** 35 **OR** 45, **as directed**, as determined according to NFRC 500

13. Sound Transmission: Fixed glazing and framing areas shall have the following sound-transmission characteristics:
    a. Outdoor-Indoor Transmission Class: Minimum 26 **OR** 30 **OR** 34, **as directed**, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
14. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
    a. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
    b. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
15. Structural-Sealant Joints:
    a. Designed to carry gravity loads of glazing.
    b. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
    c. Design reviewed and approved by structural-sealant manufacturer.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
    a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For structural-sealant-glazed curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
    a. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
    b. Include full-size isometric details of each vertical-to-horizontal intersection of structural-sealant-glazed curtain walls, showing the following:
        1) Joinery, including concealed welds.
        2) Anchorage.
        3) Expansion provisions.
        4) Glazing.
        5) Flashing and drainage.
4. Samples: For each type of exposed finish required.
5. Delegated-Design Submittal: For structural-sealant-glazed curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified Installer and testing agency.
7. Seismic Qualification Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Welding certificates.
9. Energy-Performance Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
    a. Basis for Certification: NFRC-certified energy-performance values for each structural-sealant-glazed curtain wall.
10. Product test reports.
11. Preconstruction sealant test reports.

12. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
13. Source quality-control reports.
14. Field quality-control reports.
15. Maintenance Data: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for postinstallation-phase quality-control program.
16. Warranties: Sample of special warranties.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
3. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
4. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of structural-sealant-glazed curtain walls.
5. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
6. Energy-Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   a. Provide NFRC-certified, structural-sealant-glazed curtain walls with an attached label.
7. Preinstallation Conference: Conduct conference at Project site.

F. Warranty
1. Special Assembly Warranty: Standard form in which manufacturer **OR** Installer, ,**as directed** agrees to repair or replace components of structural-sealant-glazed curtain walls that do not comply with requirements or that fail in materials or workmanship within Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
   d. Structural Profiles: ASTM B 308/B 308M.
   e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

B. Framing
1. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
2. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   b. Reinforce members as required to receive fastener threads.
   c. Use exposed fasteners with countersunk Phillips screw heads finished to match framing system **OR** fabricated from Series 300 stainless steel, **as directed**.
3. Anchors: Three-way adjustable anchors, with minimum adjustment of 1 inch (25.4 mm), that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer.
   a. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
4. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer, **as directed**.
5. Framing Sealants: Manufacturer's standard sealants with VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA method 24), **as directed**.

C. Glazing
1. Glazing: Comply with Division 08 Section "Glazing".
2. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types compatible with sealants and suitable for joint movement and assembly performance requirements.
3. Glazing Sealants: For structural-sealant-glazed curtain walls, as recommended by manufacturer for joint type, and as follows:
   a. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
      1) Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      2) Color: Black **OR** Gray **OR** As selected from manufacturer's full range of colors, **as directed**.
   b. Weatherseal Sealant: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
      1) Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      2) Color: Matching structural sealant.

D. Operable Units
1. Venting Windows: Comply with Division 08 Section "Aluminum Windows".
2. Doors: Comply with Division 08 Section "Aluminum-framed Entrances And Storefronts".

E. Accessory Materials
1. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
2. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.

F. Fabrication
1. Form or extrude aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Fabricate components that, when assembled, have the following characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Physical and thermal isolation of glazing from framing members.
   d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   e. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   f. Provisions for field replacement of glazing from exterior **OR** interior **OR** interior for vision glass and exterior for spandrel glazing or metal panels, **as directed**. Include accommodations for using temporary support device (dutchman) to retain glazing in place while sealant cures.
   g. Provisions for safety railings mounted on interior face of mullions **OR** between mullions at interior, **as directed**.
   h. Components curved to indicated radii.
   i. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain wall to exterior.
4. Factory-Assembled Frame Units:
   a. Rigidly secure nonmovement joints.
   b. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
   c. Preparation includes, but is not limited to, cleaning and priming surfaces.
   d. Seal joints watertight unless otherwise indicated.
   e. Install glazing to comply with requirements in Division 08 Section "Glazing".
5. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

G. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color and Gloss: As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish:
   a. Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      OR

      Three-coat **OR** Four-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      OR

Two-coat fluoropolymer finish complying with AAMA 2604 and containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

b. Color and Gloss: As selected from manufacturer's full range.

H. Source Quality Control

1. Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

1.3 EXECUTION

A. Installation

1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmoving joints.
   e. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
   f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   g. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
   a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
   b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain walls to exterior.
4. Install components plumb and true in alignment with established lines and grades.
5. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
6. Install glazing as specified in Division 08 Section "Glazing". Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
7. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Erection Tolerances

1. Erection Tolerances: Install to comply with the following nonaccumulating maximum tolerances:
   a. Plumb: 1/8 inch in 10 feet (3 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
   b. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
   c. Alignment:
      1) Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      2) Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      3) Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
   d. Location: Limit variation from plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing and inspecting of representative areas of structural-sealant-glazed curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
   a. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
      1) Test a minimum of two **OR** four **OR** six, **as directed**, areas on each building facade.
      2) Repair installation areas damaged by testing.
   b. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. (2.25 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
      1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of structural-sealant-glazed curtain wall.
      2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
         OR
         Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.
   c. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
      1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of structural-sealant-glazed curtain wall.
      2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
         OR
         Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.
   d. Water Spray Test: Before installation of interior finishes has begun, areas designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      1) Test Area: A minimum area of 75 feet (23 m) by one story of structural-sealant-glazed curtain wall.
3. Structural-sealant-glazed curtain walls will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 08 44 13 00a

SECTION 08 44 13 00b - SLOPED GLAZING ASSEMBLIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for sloped glazing systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Conventionally glazed sloped glazing assemblies.
b. Two-sided, structural-sealant-glazed sloped glazing assemblies.
c. Four-sided, structural-sealant-glazed sloped glazing assemblies.

C. Performance Requirements
1. General Performance: Sloped glazing assemblies shall withstand movements of supporting structure (where applicable) without failure due to defective manufacture, fabrication, installation, or other defects in construction.
a. Sloped Glazing Assemblies: Comply with performance requirements specified, as determined by testing manufacturer's standard assemblies representing those indicated for this Project.
b. Failures also include, but are not limited to, the following:
1) Thermal stresses transferring to building structure.
2) Glass breakage.
3) Noise or vibration created by wind and thermal and structural movements.
4) Loosening or weakening of fasteners, attachments, and other components.
5) Failure of operating units.
6) Glazing-to-glazing contact.
2. Delegated Design: Design sloped glazing assemblies, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Performance: Sloped glazing assemblies shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
a. Wind Loads: As indicated on Drawings **OR as directed**.
1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
b. Snow Loads: As indicated on Drawings **OR as directed**.
c. Concentrated Live Loads: As indicated on Drawings **OR as directed**, applied to framing members at locations that will produce greatest stress or deflection.
d. Uniform Live Loads: As indicated on Drawings **OR as directed**.
e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
f. Blast Loads: As indicated on Drawings **OR as directed**.
g. Periodic Maintenance-Equipment Loads: As indicated on Drawings **OR as directed**.
4. Structural Performance: Provide sloped glazing assemblies tested according to ASTM E 330, as follows:
a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.

b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
c. Test Durations: As required by design wind velocity, but not less than 10 seconds.

5. Deflection of Framing Members: At design wind pressure, as follows:
   a. Deflection Normal to Glazing Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite **OR** 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans more than 13 feet 6 inches (4.1 m), **as directed**, or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
   b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.
6. Flexural Members: Design for lateral bracing of compression flanges by cross members with minimum depth equal to 50 percent of braced flexural member. Glazing does not provide lateral support.
7. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 **OR** Zone 2 **OR** Zone 3 **OR** Zone 4, **as directed**.
   a. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
   b. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
8. Seismic Performance: Sloped glazing assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
9. Story Drift: Accommodate design displacement of adjacent stories indicated.
   a. Design Displacement: As indicated on Drawings **OR as directed**.
   b. Test Performance: Meet criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
10. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
11. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
    a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
12. Thermal Movements: Allow for thermal movements from the following maximum change (range) in ambient and surface temperature:
    a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
    b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
    c. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.
13. Energy Performance: Sloped glazing assemblies shall have certified and labeled energy-performance ratings according to the NFRC.

a. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) **OR** 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, as determined according to NFRC 100.
b. Solar Heat-Gain Coefficient: Fixed glazing and framing areas shall have an SHGC of not more than 0.35 **OR** 0.40 **OR** 0.45, **as directed**, as determined according to NFRC 200.
c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified CR rating of not less than 15 **OR** 25 **OR** 35 **OR** 45, as **directed**, as determined according to NFRC 500.

14. Sound Transmission: Fixed glazing and framing areas shall have the following characteristics:
a. Outdoor-Indoor Transmission Class: Minimum 26 **OR** 30 **OR** 34, **as directed**, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

15. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant glazing without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
a. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
b. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

16. Structural-Sealant Joints:
a. Designed to carry gravity loads of glazing.
b. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
c. Design reviewed and approved by structural-sealant manufacturer.

D. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Data for Credit EQ 4.1: For glazing sealants used inside the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For sloped glazing assemblies. Include plans, elevations, sections, details, and attachments to other work.
a. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
b. Include full-size isometric details of each vertical-to-horizontal intersection of assembly, showing the following:
1) Joinery including concealed welds.
2) Anchorage.
3) Expansion provisions.
4) Glazing.
5) Flashing and drainage.
4. Samples: For each type of exposed finish required.
5. Delegated-Design Submittal: For sloped glazing assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified Installer and testing agency.
7. Seismic Qualification Certificates: For sloped glazing assemblies, accessories, and components, from manufacturer.
a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Welding certificates.

9. Product test reports.
10. Preconstruction sealant test reports.
11. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
12. Source quality-control reports.
13. Field quality-control reports.
14. Maintenance data.
15. Warranties: Sample of special warranties.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
3. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
4. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation.
5. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
6. NFRC Certification: Provide NFRC-certified and -labeled sloped glazing assemblies.
7. Preinstallation Conference: Conduct conference at Project site.

F. Warranty
1. Special Assembly Warranty: Standard form in which manufacturer **OR** Installer, **as directed**, agrees to repair or replace components of sloped glazing assemblies that do not comply with requirements or that fail in materials or workmanship within Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
   d. Structural Profiles: ASTM B 308/B 308M.
   e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2. Steel Reinforcement: With manufacturer's standard, zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

B. Framing
1. Framing Members: Manufacturer's standard, formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

a. Framing-Member Type: Self-supporting **OR** Skin type, supported by structural-steel members indicated, **as directed**.
b. Glass Retention: Field-installed pressure caps on four sides **OR** Field-installed structural sealant at horizontal members (purlins) and pressure caps at rafters **OR** Factory-installed structural sealant on four sides, **as directed**.

2. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
   a. Include snap-on aluminum trim that conceals fasteners.
3. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning assembly components.
4. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   a. At pressure caps, use ASTM A 193/A 193M stainless-steel screws.
   b. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   c. Reinforce members as required to receive fastener threads.
   d. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system **OR** fabricated from Series 300 stainless steel, **as directed**.
5. Anchors: Three-way adjustable anchors, with minimum adjustment of 1 inch (25 mm), that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials, and recommended by manufacturer.
   a. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with requirements in ASTM A 123/A 123M or ASTM A 153/A 153M.
6. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), galvanized steel.
7. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M; of type recommended by manufacturer, **as directed**.
8. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
9. Framing Sealants: Manufacturer's standard.

C. Glazing
1. General: Comply with Division 08 Section "Glazing".
2. Glazing Gaskets: Manufacturer's standard resilient elastomeric glazing gaskets, setting blocks, and shims or spacers **OR** As specified in Division 08 Section "Glazing", **as directed**.
3. Glazing Sealants: As recommended by manufacturer **OR** Comply with Division 08 Section "Glazing", **as directed**.
   a. Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Glazing Sealants: For structural-sealant glazing, as recommended by manufacturer for joint type, and as follows:
   a. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in sloped glazing assemblies indicated.
      1) Provide sealants for use inside the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      2) Color: Black **OR** Gray **OR** As selected from manufacturer's full range of colors, **as directed**.
   b. Weatherseal Sealant: ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and sloped glazing assembly manufacturers for this use.
      1) Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) Color: Matching structural sealant.

5. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

D. Accessory Materials
1. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 33 requirements except containing no asbestos, formulated for 30-mil (0.76-mm) thickness per coat.
2. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.

E. Fabrication
1. Form or extrude aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Fabricate components that, when assembled, have the following characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Physical and thermal isolation of glazing from framing members.
   d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   e. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   f. Components curved to indicated radii.
   g. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Fabricate continuous, one-piece-type aluminum sill closures with weep holes.
5. Four-Sided, Structural-Sealant-Glazed Frame Units:
   a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
   b. Preparation includes, but is not limited to, cleaning and priming surfaces.
   c. Seal joints watertight unless otherwise indicated.
   d. Factory install glazing to comply with requirements in Division 08 Section "Glazing".
6. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

F. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color and Gloss: As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish:
   a. Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   OR
   Three-coat **OR** Four-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both

color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

OR

Two-coat fluoropolymer finish complying with AAMA 2604 and containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

b. Color and Gloss: As selected from manufacturer's full range.

G. Source Quality Control

1. Four-Sided, Structural-Sealant Glazing: Perform quality-control procedures complying with recommendations in ASTM C 1401 including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

1.3 EXECUTION

A. Installation

1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmovement joints.
   e. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
   f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   g. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
   a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
   b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
   c. Where aluminum will contact pressure-treated wood, separate dissimilar materials by method recommended by sloped glazing assembly manufacturer.
3. Install continuous sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the sloped glazing assembly to exterior.
5. Install components plumb and true in alignment with established lines and grades.
6. Install glazing as specified in Division 08 Section "Glazing".
   a. Two-Sided, Structural-Sealant Glazing:
      1) Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
      2) Install weatherseal sealant according to Division 08 Section "Glazing" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Erection Tolerances

1. General: Install sloped glazing assemblies to comply with the following maximum tolerances:
   a. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
   b. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise limit offset to 1/8 inch (3 mm).

c. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (13 mm) over total length.

C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing and inspecting of representative areas of sloped glazing assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
   a. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
      1) Test a minimum of two **OR** four **OR** six, **as directed**, areas on each assembly face.
      2) Repair installation areas damaged by testing.
   b. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. (2.25 L/s per sq. m), of assembly surface area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
      1) Test Area: One bay wide, but not less than 30 by 30 feet (9.1 by 9.1 m) of sloped glazing assembly.
      2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
         OR
         Perform tests in each test area as directed by the Owner. Perform at least three tests prior to 10, 35, and 70 percent completion.
   c. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
      1) Test Area: One bay wide, but not less than 30 by 30 feet (9.1 by 9.1 m) of sloped glazing assembly.
      2) Perform a minimum of two **OR** three tests in areas as directed by the Owner.
         OR
         Perform tests in each test area as directed by the Owner. Perform at least three tests prior to 10, 35, and 70 percent completion.
   d. Water-Spray Test: Before installation of interior finishes has begun, areas designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      1) Test Area: A minimum area of 30 by 30 feet (9.1 by 9.1 m) of sloped glazing assembly.
3. Sloped glazing assemblies will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 08 44 13 00b

SECTION 08 45 23 00 - UNIT SKYLIGHTS

1.1 GENERAL

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

B. Summary
1. Section Includes:
   a. Self-flashing unit skylights with integral curb.
   b. Unit skylights mounted on prefabricated **OR** site-built, **as directed**, curbs.

C. Performance Requirements
1. AAMA/WDMA Performance Requirements: Provide unit skylights of performance class and grade indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
   a. Performance Class and Grade:
      1) SKG-R15/15-1200x1200 **OR** SKP-R15/15-1200x1200, **as directed**.
      2) SKG-C30/30-1200x1200 **OR** SKP-C30/30-1200x1200, **as directed**.
      3) SKG-HC40/40-1200x2500 **OR** SKP-HC40/40-1200x2500, **as directed**.
      4) As indicated.
2. Windborne-Debris-Impact-Resistance Performance: Provide unit skylights that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**.
   a. Large-Missile Impact: For unit skylights located within 30 feet (9.1 m) of grade.
   b. Small-Missile Impact: For unit skylights located more than 30 feet (9.1 m) above grade.

D. Submittals
1. Product Data: For each type of unit skylight indicated.
2. Shop Drawings: For unit skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.
   a. Unit Skylight Operating System: Show locations, mounting, and details for installing operator components and controls.
   b. Unit Skylight Operating System: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
   c. Wiring Diagrams: For power, signal, and control wiring for electric motors of operable unit skylights.
3. Samples: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.
4. Qualification Data.
5. Product Test Reports.
6. Field quality-control reports.
7. Maintenance Data: For unit skylights and unit skylight operating system to include in maintenance manuals.
8. Warranty: Sample of special warranty.

E. Quality Assurance
1. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

2. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.
3. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   a. Self-Ignition Temperature: 650 deg F (343 deg C) or more for plastic sheets in thickness indicated when tested per ASTM D 1929.
   b. Smoke-Production Characteristics: Comply with either requirement below:
      1) Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
      2) Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
   c. Burning Characteristics: Tested per ASTM D 635.
      1) Acrylic Glazing: Class CC2, burning rate of 2-1/2 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
      2) Polycarbonate Glazing: Class CC1, burning extent of 1 inch (25 mm) or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
      3) Polycarbonate-Insulating-Panel Glazing: Class CC2, burning rate of 2-1/2 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Unit Skylight Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   a. Provide AAMA-certified unit skylights with an attached label.
6. Preinstallation Conference: Conduct conference at Project site.

F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum Components:
   a. Sheets: ASTM B 209 (ASTM B 209M), alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad Alloy 3005-H25.
   b. Extruded Shapes: ASTM B 221 (ASTM B 221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52.
2. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.
   a. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

B. Glazing
1. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Finish 1 (smooth or polished), Type UVF (formulated with UV absorber).
   a. Single-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.

1) Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
2) Color: Colorless, transparent **OR** White, translucent **OR** Bronze-tinted, transparent **OR** Gray-tinted, transparent, **as directed**.

b. Double-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.
1) Thicknesses: As indicated **OR** Not less than thicknesses required to exceed performance requirements, **as directed**.
2) Outer Glazing Color: Colorless, transparent **OR** White, translucent **OR** Bronze-tinted, transparent **OR** Gray-tinted, transparent, **as directed**.
3) Inner Glazing Color: Colorless, transparent **OR** White, translucent **OR** Bronze-tinted, transparent **OR** Gray-tinted, transparent, **as directed**.

2. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated per UL 972, and with average impact strength of 12 to 16 ft-lb/in. (640 to 854 J/m) of width when tested per ASTM D 256, Test Method A (Izod).
a. Single-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.
1) Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
2) Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
b. Double-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.
1) Thicknesses: As indicated **OR** Not less than thicknesses required to exceed performance requirements, **as directed**.
2) Inner Glazing Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
3) Outer Glazing Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.

3. Insulating Glass: Clear, sealed units that comply with Division 08 Section "Glazing", in manufacturer's standard overall thickness.
a. Exterior Lite: 1/4-inch (6-mm) clear **OR** tinted, **as directed,** heat-strengthened **OR** fully tempered, **as directed**, glass.
b. Interior Lite:
1) Laminated glass; 2 plies of 1/8-inch (3-mm) clear heat-strengthened glass with 0.030-inch (0.762-mm) clear polyvinyl butyral interlayer.
2) 1/4-inch (6-mm) clear **OR** tinted, **as directed,** heat-strengthened **OR** fully tempered **OR** wire, **as directed**, glass.
c. Interspace Content: Air **OR** Argon, **as directed**.
d. Low-Emissivity Coating: Manufacturer's standard.

4. Polycarbonate-Insulating-Panel Glazing: Manufacturer's standard polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
a. Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
b. Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.

5. Fiberglass-Sandwich-Panel Glazing: Manufacturer's standard with uniformly colored, translucent, fiberglass-reinforced-polymer face sheets permanently adhered to a grid core.
a. Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
b. Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.

6. Glazing Gaskets: Manufacturer's standard **OR** EPDM, neoprene, partially vulcanized butyl tape, or liquid-applied elastomeric sealant, **as directed**.

C. Installation Materials
1. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil (0.4-mm) dry film thickness per coating.

2. Joint Sealants: As specified inDivision 07 Section "Joint Sealants".
3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
4. Roofing Cement: ASTM D 4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

D. Unit Skylights
1. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding performance requirements indicated.
2. Integral Curb: Extruded-aluminum **OR** Vinyl **OR** Reinforced-thermoset-fiberglass profile, **as directed**, self-flashing type.
   a. Height: As indicated **OR** 8 inches (200 mm) **OR** 9 inches (225 mm) **OR** 12 inches (300 mm), **as directed**.
   b. Construction: Single **OR** Double, **as directed**, wall.
   c. Insulation: Manufacturer's standard rigid or semirigid type.
3. Prefabricated Curb: As specified in Division 07 Section "Roof Accessories".
4. Site-Built Curb: As indicated.
5. Unit Shape and Size: As indicated **OR** Square, 40-by-40-inch (1016-by-1016-mm) inside curb **OR** Rectangular, 40-by-48-inch (1016-by-1220-mm) inside curb **OR** Circular, 40-inch- (1016-mm-) diameter inside curb, **as directed**.
6. Condensation Control: Fabricate unit skylights with integral internal gutters and non-clogging weeps to collect and drain condensation to the exterior.
7. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.
8. Operable Unit Skylight System: Equip vent-type unit skylights with manufacturer's standard hinges, chain-driven operating hardware, and weather-sealing gaskets.
   a. Manual Operator: Manufacturer's standard, rotary-crank extension device.
      1) Pole Operator: Manual, 60 inches (1524 mm) long **OR** Manual, telescoping to 144 inches (3658 mm) **OR** Rechargeable-motor power-driven type, telescoping to 144 inches (3658 mm), **as directed**.
   b. Motor Operator: Manufacturer's standard electronic control, including switch, transformer, low-voltage motor, cover, and mounting hardware.
      1) Provide motor of size and capacity recommended by unit skylight manufacturer to suit unit skylight indicated.
      2) Provide rain sensor that automatically closes venting unit when water is detected.
      3) Provide motor operator with portable remote-control device.
9. Security Grilles: 1/2-inch- (13-mm-) diameter, hardened steel bars spaced not more than 5 inches (130 mm) o.c. in 1 direction and 16 inches (400 mm) o.c. in other direction **OR** 5 inches (130 mm) o.c. in both directions, **as directed**.
10. Protective Screens: Manufacturer's standard to protect interior glazing lite from breakage **OR** personnel from falls **OR** against windborne debris **OR** against hail, **as directed**.

E. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

F. Aluminum Finishes
1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.

a. Color: As selected from full range of industry colors and color densities.

4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. High-Performance Organic Finish: 3 **OR** 4, **as directed**,-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
2. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.
3. Install unit skylights level, plumb, and true to line, without distortion.
4. Anchor unit skylights securely to supporting substrates.
5. Where metal surfaces of unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.
6. Set unit skylight flanges in thick bed of roofing cement to form a seal unless otherwise indicated.
7. Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

B. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.
3. Perform test for total area of each unit skylight.
4. Work will be considered defective if it does not pass tests and inspections.
5. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Cleaning

1. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.
2. Remove excess sealants, glazing materials, dirt, and other substances.
3. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.
4. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

5. Unit Skylight Operating System: Clean and lubricate joints and hardware. Adjust for proper operation.

END OF SECTION 08 45 23 00

SECTION 08 45 23 00a - METAL-FRAMED SKYLIGHTS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for metal-framed skylights. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes aluminum-framed skylights with the following characteristics:
   a. Glazing is glass **OR** plastic, **as directed**.
   b. Glazing is retained by field-installed pressure caps on four sides **OR** field-installed structural sealant at horizontal members (purlins) and pressure caps at rafters **OR** factory-installed structural sealant on four sides, **as directed**.

C. Performance Requirements
1. Provide metal-framed skylights, including anchorage, capable of withstanding, without failure, the effects of the following:
   a. Structural loads.
   b. Thermal movements.
   c. Movements of supporting structure.
   d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Water leakage.
   c. Thermal stresses transferred to building structure.
   d. Noise or vibration created by wind and thermal and structural movements.
   e. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
   f. Loosening or weakening of fasteners, attachments, and other components.
   g. Sealant failure.
3. Structural Loads:
   a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
   b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
   c. Concentrated Live Loads: 250 lbf (1112 N) applied to framing members at locations that will produce greatest stress or deflection.
   d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
   e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
4. Deflection of Framing Members:
   a. Deflection Normal to Glazing Plane:
      1) Spans Up to 20 Feet (6 m): Limited to 1/175 **OR** 1/180, **as directed**, of clear span or 1 inch (25.4 mm), whichever is smaller.
      2) Spans Exceeding 20 Feet (6 m): Limited to 1/240 of clear span.
      3) Glass Edge Deflection: Limit edge deflection of individual glass lites to 3/4 inch (19 mm).
   b. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.

5. Lateral Bracing of Framing Members: Compression flanges of flexural members are laterally braced by cross members with minimum depth equal to 50 percent of flexural member that is braced. Glazing does not provide lateral support.
6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
7. Structural-Sealant Glazing:
   a. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by metal-framed skylight assemblies without failing adhesively or cohesively. Sealant fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.
      1) Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
      2) Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
   b. Structural-Sealant Joints: Designed to produce tensile or shear stress in structural-sealant joints of less than 20 psi (138 kPa).
      1) Structural-sealant joints do not carry gravity loads of glazing.

D. Performance Testing
1. Provide metal-framed skylights that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
2. Structural-Performance Test: ASTM E 330.
   a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
   a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind **OR** 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind, **as directed**.
   b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m).
4. Test for Water Penetration under Static Pressure: ASTM E 331.
   a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
   b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
   a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft. (574 Pa).
   b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:

a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, including printed statement of VOC content.

3. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work.
   a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Samples: For each exposed finish.
5. Compatibility Test Reports: For structural-sealant-glazed skylights, preconstruction test reports from structural- and nonstructural-sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results for sealant performance and written recommendations for primers and substrate preparation needed for adhesion.
6. Field quality-control test and inspection reports.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for metal-framed skylights.
8. Structural-Sealant-Glazing, Quality-Control Program: Developed specifically for Project.
9. Structural-Sealant-Glazing, Quality-Control Program Reports: Documenting quality-control procedures and verifying results for metal-framed skylights.
10. Maintenance Data: For metal-framed skylights to include in maintenance manuals.
11. Warranties: Special warranties specified in this Section.

F. Quality Assurance
1. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
2. Compatibility Testing: For structural-sealant-glazed skylights, perform structural- and nonstructural-sealant manufacturer's standard preconstruction tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by metal-framed skylights.
3. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
4. Structural-Sealant Glazing: Comply with recommendations in ASTM C 1401, "Guide for Structural Sealant Glazing," for joint design and quality-control procedures.
   a. Joint designs are reviewed and approved by structural-sealant manufacturer.
5. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Structural failures including, but not limited to, excessive deflection.
      2) Noise or vibration caused by thermal movements.
      3) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      4) Adhesive or cohesive sealant failures.
      5) Water leakage.
   b. Warranty Period: Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
   b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Framing Systems
1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
   a. Include snap-on aluminum trim that conceals fasteners.
3. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
4. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
   a. At pressure caps, use ASTM A 193/A 193M, 300 series stainless-steel screws.
   b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   c. Exposed Fasteners:
      1) Use exposed fasteners with countersunk Phillips screw heads.
   d. Finish exposed portions to match framing system.
   e. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
5. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
6. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
7. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended in writing by manufacturer, **as directed**.
8. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.030 inch (0.762 mm) **OR** 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
9. Framing Gaskets: Manufacturer's standard.
10. Framing Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
    a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Glazing Systems
1. Glazing: As specified in Division 08 Section(s) "Glazing" OR "Plastic Glazing", **as directed**.
2. Spacers, Setting Blocks, and Gaskets: Manufacturer's standard elastomeric types **OR** As specified in Division 08 Section "Glazing", **as directed**.
3. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
4. Glazing Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
   a. Provide sealants for use inside of the weatherproofing system that have a VOC content as indicated when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in metal-framed skylights indicated.
      1) VOC Content: 100 g/L or less.
      2) Color: Black **OR** As selected from manufacturer's full range, **as directed**.

c. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other components with which it comes in contact; and recommended in writing by structural- and weatherseal-sealant and metal-framed skylight manufacturers for this use.
   1) VOC Content: 250 g/L or less.
   2) Color: Matching structural sealant.

C. Accessory Materials
1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

D. Fabrication
1. Fabricate aluminum components before finishing.
2. Fabricate aluminum components that, when assembled, have the following characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
   d. Physical and thermal isolation of glazing from framing members.
   e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
3. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
4. Reinforce aluminum components as required to receive fastener threads.
5. Weld aluminum components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
6. Factory-Glazed Units:
   a. Factory install glazing to comply with requirements in Division 08 Section(s) "Glazing" OR "Plastic Glazing", **as directed**.
   b. Prepare surfaces that will contact structural sealant according to structural-sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
7. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

E. Aluminum Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
4. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
5. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
6. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive

primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 **OR** AAMA 2605, **as directed**, and with coating and resin manufacturers' written instructions.

7. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
   a. Color and Gloss: As selected from manufacturer's full range.

F. Source Quality Control
1. Structural-Sealant Glazing: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, material qualification procedures, sealant testing, and fabrication reviews and checks.

1.3 EXECUTION

A. Installation
1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmovement joints.
   e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install glazing as specified in Division 08 Section(s) "Glazing" OR "Plastic Glazing", **as directed**.
   a. Structural-Sealant Glazing:
      1) Prepare surfaces that will contact structural sealant according to structural-sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
      2) Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to weatherseal-sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind weatherseal sealant as recommended in writing by weatherseal-sealant manufacturer.
7. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
8. Erection Tolerances: Install metal-framed skylights to comply with the following maximum tolerances:

a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m) but no greater than 1/2 inch (13 mm) over total length.

B. Field Quality Control
a. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
1) Destructive test method, Method A, Hand Pull Tab (Destructive) in ASTM C 1401, Appendix X2, shall be used.
a) A minimum of one **OR** two, **as directed**, area(s) on each skylight face shall be tested.
b) Repair installation areas damaged by testing.
b. Structural-Sealant Glazing Inspection: After installation of metal-framed skylights is complete, structural-sealant glazing shall be inspected and evaluated according to ASTM C 1401 recommendations for quality-control procedures.
c. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
1) Test Procedures: Test under uniform and cyclic static air pressure.
2) Water Penetration: None.
d. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 and shall not evidence water penetration.
2. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08 45 23 00a

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SECTION 08 45 23 00b - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for structured-polycarbonate-panel assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes aluminum-framed assemblies glazed with multiwalled (structured) polycarbonate panels as follows:
   a. Wall assemblies.
   b. Roof (sloped, overhead) assemblies.
   c. Skylight assemblies.

C. Performance Requirements
1. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
   a. Structural loads.
   b. Thermal movements.
   c. Movements of supporting structure.
   d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Water leakage.
   c. Thermal stresses transferred to building structure.
   d. Noise or vibration created by wind and thermal and structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.

D. Structural Loads:
   a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
   b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
   c. Concentrated Live Loads on Overhead Assemblies: 300 lbf (1334 N) applied to assemblies at locations that will produce greatest stress or deflection.
   d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
   e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
2. Deflection of Assemblies:
   a. Vertical Assemblies: Limited to 1/100 of clear span for each assembly component.
   b. Overhead Assemblies: Limited to 1/100 **OR** 1/180, **as directed**, of clear span for each assembly component.
3. Roof Assemblies: Class A **OR** B **OR** C, **as directed**, per ASTM E 108 or UL 790.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Performance Testing
1. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.

2. Structural-Performance Test: ASTM E 330.
   a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
   a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
   b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m).
4. Test for Water Penetration under Static Pressure: ASTM E 331.
   a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
   b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
   a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
   b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

F. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
   a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, documentation including printed statement of VOC content.
3. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
   a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Samples: For each exposed finish.
5. Field quality-control test reports.
6. Product test reports.
7. Maintenance data.
8. Special warranties specified in this Section.

G. Quality Assurance
1. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
2. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
4. Preinstallation Conference: Conduct conference at Project site.

H. Warranty
1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Structural failures including, but not limited to, excessive deflection.

2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
3) Water leakage.

b. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.

2. Special Structured-Polycarbonate-Panel Warranty: Manufacturer's standard form agreeing to replace polycarbonate sheet that breaks or develops defects from normal use that are attributed to manufacturing process and not to practices for maintaining and cleaning products contrary to manufacturer's written instructions.
   a. Defects include, but are not limited to, the following:
      1) Delamination.
      2) Color changes from original in excess of 3.0 units Delta E when measured per ASTM D 2244.
      3) Losses in light transmission beyond 6 percent from original when measured per ASTM D 1003.
   b. Warranty Period: 10 years from date of Final Completion.
3. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
   b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Framing Systems
1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
   a. Construction: One-piece extruded-aluminum components **OR** Thermally broken; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
3. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
4. Framing Gaskets: Manufacturer's standard.
5. Framing Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
   a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
   a. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
   b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   c. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
7. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
8. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.

9. Framing System Fabrication:
   a. Fabricate components before finishing.
   b. Fabricate components that, when assembled, have the following characteristics:
      1) Profiles that are sharp, straight, and free of defects or deformations.
      2) Accurately fitted joints with ends coped or mitered.
      3) Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within assembly to exterior.
   c. Fabricate sill closures with weep holes and for installation as continuous component.
   d. Reinforce components as required to receive fastener threads.
   e. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

B. Structured Polycarbonate Panels
1. General: Translucent, extruded-polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
   a. Plastic Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
   b. Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
   c. Burning Rate: 2.5 in/.min. (1.06 mm/s) or less per ASTM D 635.
   d. Smoke-Developed Index: 450 or less per ASTM E 84, or 75 or less per ASTM D 2843.
   e. Flame-Spread Index: Not more than 25 per ASTM E 84.
   f. Exterior-Fire-Exposure Class: Class A **OR** B **OR** C, **as directed**, per ASTM E 108 or UL 790.
2. Panel U-Factor: Not more than 0.73 (4.15) **OR** 0.63 (3.58) **OR** 0.48 (2.73) **OR** 0.38 (2.16) **OR** 0.24 (1.36) **OR** 0.22 (1.25), **as directed**, measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to ASTM C 1363 and using procedures described in ASTM C 1199 and ASTM E 1423.
3. Color Stability: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering according to procedures in ASTM D 1435.
   a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.
4. Impact Resistance: No failure at impact of 200 ft. x lbf (271 J) according to free-falling-ball impact test using a 3-1/2-inch- (89-mm-) diameter, 6.3-lb (2.9-kg) ball.

C. Accessory Materials
1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

D. Aluminum Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
3. Aluminum Anodic Finish: Class I, clear anodic coating complying with AAMA 611 **OR** Class I, color anodic coating complying with AAMA 611, **as directed**.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and densities, **as directed**.
4. Aluminum High-Performance Organic Finish: Two-coat **OR** Three-coat, **as directed**, thermocured system with fluoropolymer topcoats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604 **OR** AAMA 2605, **as directed**.
   a. Color and Gloss: As selected from manufacturer's full range.

1.3 EXECUTION

A. Installation
1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmovement joints.
   e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   f. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within aluminum members, and moisture migrating within assembly to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
7. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
   a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
   b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

B. Field Quality Control
1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing and inspecting of representative areas to determine compliance of installed assemblies with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
   a. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
      1) Test Procedures: Test under uniform and cyclic static air pressure.
      2) Static-Air-Pressure Difference: as directed by the Owner.
      3) Water Penetration: None.
   b. Water-Spray Test: Before installation of interior finishes has begun, assemblies shall be tested according to AAMA 501.2 and shall not evidence water penetration.
3. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08 45 23 00b

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SECTION 08 45 23 00c - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for fiberglass-sandwich-panel assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes assemblies incorporating fiberglass sandwich panels and aluminum frame systems as follows:
   a. Wall assemblies.
   b. Roof (sloped, overhead) assemblies.
   c. Skylight assemblies.

C. Performance Requirements
1. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
   a. Structural loads.
   b. Thermal movements.
   c. Movements of supporting structure.
   d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Water leakage.
   c. Thermal stresses transferred to building structure.
   d. Noise or vibration created by wind and thermal and structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.
   f. Delamination of fiberglass-sandwich-panel faces from panel cores.
3. Structural Loads:
   a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
   b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
   c. Concentrated Live Loads on Overhead Assemblies: 300 lbf (1334 N) applied to assemblies at locations that will produce greatest stress or deflection.
   d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
   e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
4. Deflection of Assemblies:
   a. Vertical Assemblies: Limited to 1/60 **OR** 1/90 **OR** 1/180, **as directed**, of clear span for each assembly component.
   b. Overhead Assemblies: Limited to 1/60 **OR** 1/90 **OR** 1/180, **as directed**, of clear span for each assembly component.
5. Roof Assemblies: Class A per ASTM E 108 or UL 790.
6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Performance Testing

1. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
2. Structural-Performance Test: ASTM E 330.
   a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
   a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
   b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m), **as directed**.
4. Test for Water Penetration under Static Pressure: ASTM E 331.
   a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (479 Pa).
   b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
   a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
   b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
6. Water-Penetration, Wind-Driven-Rain Test: Wind-driven-rain test in ICBO ES AC07, "Special Roofing Systems."
   a. Water Leakage: None.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
   a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, documentation including printed statement of VOC content.
3. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
   a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Field quality-control test reports.
5. Product test reports.
6. Maintenance data.
7. Special warranties specified in this Section.

F. Quality Assurance
1. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.
2. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels."
3. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

4. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
5. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."
6. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Structural failures including, but not limited to, excessive deflection.
      2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      3) Water leakage.
   b. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.
2. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
   a. Defects include, but are not limited to, the following:
      1) Fiberbloom.
      2) Delamination of coating, if any, from exterior face sheet.
      3) Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
      4) Delamination of panel face sheets from panel cores.
   b. Warranty Period: 10 years from date of Final Completion.
3. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
   b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Frame Systems
1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
   a. Construction: One-piece extruded-aluminum components **OR** Thermally broken; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
3. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
4. Frame-System Gaskets: Manufacturer's standard.
5. Frame-System Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
   a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.

a. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
c. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

7. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
8. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
9. Frame System Fabrication:
   a. Fabricate components before finishing.
   b. Fabricate components that, when assembled, have the following characteristics:
      1) Profiles that are sharp, straight, and free of defects or deformations.
      2) Accurately fitted joints with ends coped or mitered.
      3) Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.
   c. Fabricate sill closures with weep holes and for installation as continuous component.
   d. Reinforce components as required to receive fastener threads.
   e. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

B. Fiberglass Sandwich Panels
1. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."
   a. Face-Sheet, Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
   b. Face-Sheet Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
   c. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
   d. Interior Face-Sheet, Flame-Spread Index: Not more than 25 **OR** 75, **as directed**, per ASTM E 84.
   e. Roof-Covering Class: Class A **OR** Class A, burning brand test (only), **as directed**, per ASTM E 108 or UL 790.
2. Panel Thickness: 2-3/4 inches (70 mm) **OR** 1-1/2 to 1-9/16 inches (38 to 40 mm), **as directed**.
3. Panel U-Factor: Not more than 0.70 (3.97) **OR** 0.53 (3.01) **OR** 0.44 (2.50) **OR** 0.40 (2.27) **OR** 0.29 (1.65) **OR** 0.28 (1.59) **OR** 0.26 (1.48) **OR** 0.24 (1.36) **OR** 0.23 (1.31) **OR** 0.22 (1.25) **OR** 0.18 (1.02) **OR** 0.15 (0.85) **OR** 0.14 (0.79) **OR** 0.10 (0.57), **as directed**, measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to NFRC 100 or ASTM C 1363 using procedures described in ASTM C 1199 and ASTM E 1423.
4. Panel Strength Characteristics:
   a. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/ sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after 5 minutes.
   b. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334 N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.
5. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).
   a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.

b. I-Beam Construction: One-piece extruded-aluminum components **OR** Thermally broken; two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
c. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm) **OR** Staggered rectangle, nominal 12 by 24 inches (305 by 610 mm) **OR** Square, nominal 12 inches (305 mm) **OR** As indicated on Drawings, **as directed**.

6. Exterior Face Sheet:
   a. Thickness: 0.070 inches (1.778 mm) **OR** 0.060 inches (1.524 mm) **OR** 0.052 inches (1.321 mm), **as directed**.
   b. Color: White **OR** Crystal **OR** As selected from manufacturer's full range, **as directed**.
   c. Color Stability: Not more than 3.0 **OR** 4.0 **OR** 7.0, **as directed**, units Delta E when measured according to ASTM D 2244 after outdoor weathering in southern Florida according to procedures in ASTM D 1435 with panels mounted facing south and as follows:
      1) Panel Mounting Angle: Not more than 5 **OR** 45, **as directed**, degrees from horizontal.
      2) Exposure Period: 60 months **OR** 30 months **OR** 60 months for vertical assemblies, 30 months for components of Class A roof assemblies, **as directed**.
   d. Erosion Protection: Manufacturer's standard **OR** Integral, embedded glass erosion barrier **OR** Surface-applied, polyvinyl fluoride film not less than 1.0 mils (0.03 mm) thick, **as directed**.
   e. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) **OR** 70 ft. x lbf (95 J) **OR** 230 ft. x lbf (312 J), **as directed**, by a 3-1/4-inch- (83-mm-) diameter, 5-lb (2.3-kg) free-falling ball according to test procedure in UL 972.
7. Interior Face Sheet:
   a. Thickness: 0.045 inch (1.143 mm) **OR** 0.060 inch (1.524 mm), **as directed**.
   b. Color: White **OR** Crystal **OR** As selected from manufacturer's full range, **as directed**.
8. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.
   a. Compatible with facing and core materials.
   b. Tensile and shear bond strength of aged adhesive ensures permanent adhesion of facings to cores, as evidenced by testing according to ASTM C 297 and ASTM D 1002 after accelerated aging procedures that comply with aging requirements for adhesives with high resistance to moisture in ICBO ES AC05, "Sandwich Panel Adhesives."
9. Panel Fabrication: Factory assemble and seal panels.
   a. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
      1) White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).
   b. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
   c. Fabricate panel to allow condensation within panel to escape.
   d. Reinforce panel corners.

C. Accessory Materials
1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

D. Aluminum Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
3. Aluminum Anodic Finish: Class I, clear anodic coating complying with AAMA 611 **OR** Class I, color anodic coating complying with AAMA 611, **as directed**.

a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and densities, **as directed**.

4. Aluminum High-Performance Organic Finish: Two-coat **OR** Three-coat, **as directed**, thermocured system with fluoropolymer topcoats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604 **OR** AAMA 2605, **as directed**.
   a. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation
1. General:
   a. Comply with manufacturer's written instructions.
   b. Do not install damaged components.
   c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
   d. Rigidly secure nonmovement joints.
   e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   f. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
7. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
   a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
   b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

B. Field Quality Control
1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing and inspecting of representative areas to determine compliance of installed assemblies with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
   a. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
      1) Test Procedures: Test under uniform and cyclic static air pressure.
      2) Static-Air-Pressure Difference: as directed by the Owner.
      3) Water Penetration: None.
   b. Water-Spray Test: Before installation of interior finishes has begun, assemblies shall be tested according to AAMA 501.2 and shall not evidence water penetration.
3. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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SECTION 08 51 13 00 - ALUMINUM WINDOWS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for fixed and operable aluminum framed windows for exterior locations. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes fixed and operable aluminum-framed windows.

C. Definitions
1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
   a. AW: Architectural.
   b. HC: Heavy Commercial.
   c. C: Commercial.
   d. LC: Light Commercial.
   e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
   a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements
1. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
   a. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance **OR** optional performance grade **OR** gateway performance for both gateway performance and optional performance grade, **as directed**.
   b. Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
   a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
      2) Importance Factor.
      3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
   b. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows

identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

4. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

E. Submittals
1. Product Data: For each type of aluminum window indicated.
2. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details
3. Samples: For each exposed finish.
4. Product Schedule: Use same designations indicated on Drawings.
5. Field quality-control test reports.
6. Product test reports.
7. Maintenance data.

F. Quality Assurance
1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   a. Provide AAMA **OR** WDMA, **as directed**,-certified aluminum windows with an attached label.
4. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
5. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Failure to meet performance requirements.
      2) Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
      3) Faulty operation of movable sash and hardware.
      4) Deterioration of metals, other materials, and metal finishes beyond normal weathering.
      5) Failure of insulating glass.
   b. Warranty Period:
      1) Window: Two **OR** Three, **as directed**, years from date of Final Completion.
      2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
      3) Metal Finish: Five **OR** 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.
2. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
   a. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
   b. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
3. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
4. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
5. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
   a. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
   b. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
   c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
6. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
   a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
7. Replaceable Weather Seals: Comply with AAMA 701/702.
8. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

B. Window
1. Window Type: Casement **OR** Double hung **OR** Dual action **OR** Fixed **OR** Horizontal sliding **OR** Projected **OR** Projected awning **OR** Single hung **OR** Top-hinged inswinging **OR** Vertically pivoted **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
2. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
   a. Performance Class and Grade: R15 **OR** R20 **OR** R25**, as directed**.
   b. Performance Class and Grade: LC25 **OR** LC30 **OR** LC35, **as directed**.
   c. Performance Class and Grade: C30 **OR** C35 **OR** C40, **as directed**.
   d. Performance Class and Grade: HC40 **OR** HC45 **OR** HC50, **as directed**.
   e. Performance Class and Grade: AW40 **OR** AW45 **OR** AW50, **as directed**.
   f. Performance Class and Grade: As indicated.

g. Performance Class (if test performance method is selected for specifying windows and designating a performance class does not conflict with basic wind speed and performance testing indicated): R **OR** LC **OR** C **OR** HC **OR** AW, **as directed**.

3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52, **as directed**.
4. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed**.
   a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
5. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
7. If test performance method is selected for specifying windows
   a. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
      1) Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa).
      2) Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).
      3) Maximum Rate: 0.1 cfm/sq. ft. (2 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).
   b. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
      1) Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
      2) Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
8. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
9. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
10. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

C. Glazing
1. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".
2. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal. **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed**.
3. Dual-Action Windows: Provide pivoting unit for double glazing, constructed of one sheet of glass in a removable sash for access to interior of unit, installed with airtight gaskets.

D. Hardware
1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and

sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.

2. Counterbalancing Mechanism: Comply with AAMA 902.
   a. Sash Balance: Concealed, tape-spring type **OR** spiral-tube type **OR** spring-loaded, block-and-tackle type **OR** ultralift spring type capable of lifting 70 percent of sash weight, **as directed**, of size and capacity to hold sash stationary at any open position.
3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
5. Roller Assemblies: Low-friction design.
6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
   a. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
   a. Locking mechanism and handles for manual operation.
   b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.
9. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.
   a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.
11. Casement Windows: Provide the following operating hardware:
    a. Operator: Gear-type rotary single-arm operator located on jamb at sill **OR** Gear-type rotary dual-arm operator located on jamb at sill, **as directed**.
       1) Rating: Provide rotary operator rated C-R15 **OR** C-C20 **OR** C-HC40, **as directed**, according to AAMA 901.
       2) Handle: Standard crank **OR** Folding crank **OR** Removable crank **OR** Knob **OR** T-handle, **as directed**.
    b. Hinge: Extension hinge or pivot, nonfriction type.
    c. Hinge: Heavy-duty, three **OR** five, **as directed**,-knuckle butt hinge with nylon bushings.
    d. Hinge: Standard **OR** Heavy, **as directed**,-duty, concealed, four- or six-bar friction hinge with adjustable-slide friction shoe; designed to permit ventilator operation for inside cleaning of outside glass face; two per ventilator.
    e. Hinge: Standard **OR** Heavy, **as directed**,-duty, concealed, four- or six-bar friction egress hinge with adjustable-slide friction shoe; designed to achieve 90-degree ventilator opening and to permit ventilator operation for inside cleaning of outside glass face; two per ventilator.
    f. Lock: Lift-type throw, cam-action lock with keeper; one **OR** two, **as directed**, per ventilator.
    g. Lock: Combination lever handle and cam-action lock with keeper; one **OR** two, **as directed**, per ventilator.
    h. Lock: Combination dual lever handles, tie rod, and cam-action lock with keepers.
    i. Lock: Key-operated custodial lock and keeper with removable handle; one **OR** two, **as directed**, per ventilator.

j. Lock: Concealed multipoint lock operated by single lever handle or lift-type throw; three per ventilator.
k. Limit Device: Concealed friction adjustor, adjustable stay bar **OR** support arms with adjustable, limited, hold-open, **as directed**, limit device.

12. Double **OR** Single, **as directed**,-Hung Windows: Provide the following operating hardware:
a. Sash Balances: Two per sash.
b. Handles: Applied sash lift bar **OR** pull-downs, **as directed**, on bottom rail of forward-placed operating sash; two per sash.
c. Handle: Continuous, integral, sash lift bar **OR** pull-down, **as directed**, on bottom rail of forward-placed operating sash.
d. Sash Lock: Cam-action sweep lock and keeper on meeting rail; one **OR** two, **as directed**, per sash.
e. Sash Lock: Spring-loaded, snap-type lock on bottom rail of lower sash; two per sash.
f. Sash Lock: Spring-loaded plunger lock with keeper on meeting rail of lower sash; two per sash.
g. Sash Lock: Pole-operated, cam-action lock on meeting rail of windows with meeting rail more than 72 inches (1800 mm) above floor; with keeper.
h. Pole Socket: Provide a pole socket or groove on inside face of top rail of upper **OR** lower, **as directed**, sash on windows with meeting rails more than 72 inches (1800 mm) above floor.
i. Limit Device: Sash stop **OR** Keyed sash, **as directed**, limit device; for top **OR** bottom **OR** each operable, **as directed**, sash located at jamb; one **OR** two, **as directed**, per sash.
j. Removable Lift-Out Sash: Design windows and provide with tamperproof, key-operated, **as directed**, hardware to permit removal of sash from inside for cleaning.
k. Tilt Lock: Design windows and provide with tamperproof, key-operated, **as directed**, tilt latch and pivot bar hardware to permit tilting of sash inward for cleaning both sides of sash from interior.

13. Dual-Action Windows: Provide the following operating hardware:
a. Operator: Two-position, combination lever handle and cam-type latch.
b. Operator: Concealed, internal, multipoint locking bar and combination locking handle mechanism.
c. Hinge: Combination three-knuckle **OR** five-knuckle butt, **as directed**, hinge and stay bar.
d. Lock: Key-operated, concealed **OR** exposed, **as directed**, custodial lock.
e. Stabilizing Arm: Aluminum.

14. Horizontal-Sliding Windows: Provide the following operating hardware:
a. Sash Rollers: Nylon rollers **OR** Steel, lubricated ball-bearing rollers with nylon tires **OR** Stainless-steel, lubricated ball-bearing rollers with nylon tires, **as directed**.
b. Sash Lock: Cam-action sweep sash lock and keeper at meeting rails.
c. Sash Lock: Spring-loaded, snap-type lock at jambs; two per sash.
d. Sash Lock: Spring-loaded plunger lock with keeper on meeting rail; two per sash.
e. Limit Device: Sash stop limit device; mounted in bottom of pull stile.
f. Removable Lift-Out Sash: Design windows and provide with tamperproof, key-operated, **as directed**, hardware to permit removal of sash from inside for cleaning.

15. Projected Windows: Provide the following operating hardware:
a. Operator: Underscreen push-bar **OR** Underscreen pivot-shoe-type, gear-type rotary operator, **as directed**.
b. Hinge: Five-knuckle butt hinge.
c. Hinge: Concealed four- or six-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
d. Lock: Cam-action, sweep lock handle with strike; one **OR** two, **as directed**, per ventilator.
e. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper.
f. Lock: Key-operated security lock and keeper.
g. Lock: Key-operated custodial lock and keeper with removable handle.
h. Lock: Pole-operated, spring-catch lock and keeper **OR** cam-action, sweep lock handle and strike, **as directed**.

i. Limit Device: Concealed friction adjustor, adjustable stay bar **OR** support arms with adjustable, limited, hold-open, **as directed**, limit device; located on jamb of each ventilator.

16. Projected Awning Windows: Provide the following operating hardware:
    a. Operator: Push-bar **OR** Lever **OR** Gear-type rotary, **as directed**, operator located on jamb at sill.
        1) Handle: Standard crank **OR** Folding crank **OR** Removable crank **OR** Knob **OR** T-handle, **as directed**.
    b. Window-Operating System: Wall-mounted, group or gang-type window operating system with chain-wheel **OR** rotary crank-type **OR** electric, **as directed**, operator.
    c. Hinge: Concealed four- or six-bar friction hinge located on each jamb near top rail; two per ventilator.
    d. Lock: Lift-type throw, cam-action lock with keeper; one **OR** two, **as directed**, per ventilator.
    e. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper; one **OR** two, **as directed**, per ventilator.
    f. Lock: Pole-operated, combination handle and cam-action lock **OR** face-mounted transom latch, **as directed**, and keeper.
    g. Lock: Key-operated custodial lock with removable handle.
    h. Limit Device: Concealed friction adjustor, adjustable stay bar **OR** support arms with adjustable, limited, hold-open, **as directed**, limit device; located on jamb of each ventilator.
17. Top-Hinged Inswinging Windows: Provide the following operating hardware:
    a. Hinge: Exposed, applied butt hinge located at corners; two **OR** three, **as directed**, per ventilator.
    b. Hinge: Exposed, applied continuous hinge.
    c. Hinge: Concealed, applied pivot hinge located at corners; two **OR** three, **as directed**, per ventilator.
    d. Hinge: Continuous, integrally extruded hinge.
    e. Hinge: Four- or six-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
    f. Lock: Internal, key-operated, limited-access locks located not more than 48 inches (1220 mm) o.c. at jambs and sill.
    g. Hold-Open Device: Automatic-locking hold-open arms **OR** stay bars, **as directed**,; designed to permit sash operation for inside cleaning of outside glass face; two per ventilator.
18. Vertically Pivoted Windows: Provide the following operating hardware:
    a. Pivot Assembly: Aluminum-alloy **OR** Manganese-bronze **OR** Stainless-steel, **as directed**, pivot assembly designed for center **OR** off-center, **as directed**, axis pivoting.
    b. Lock: Internal, key-operated, limited-access lock; one **OR** two, **as directed**, per jamb.
    c. Limit device.

E. Group Or Gang-Type Window Operating Systems
1. Provide window operating system of the type and in groups as indicated. Coordinate operating system design with window fabrication and hardware selection to ensure smooth, durable operation of ventilators.
2. Operation Function: All ventilators move simultaneously and securely close at sash frames without using additional manually controlled locking devices.
3. Rack-and-Pinion **OR** Screw, **as directed**,-Type Operating System: Complete with shafts, brackets, levers, rods, oil-encased gear boxes, and standard fittings and accessories for operation indicated.
4. Horizontal-Movement Operating System: Tension type; complete with mounting brackets, oil-encased gear boxes, steel rod or cable operating in conduit between sash operator units, and standard fittings and accessories for operation indicated.
5. Operation: Manual, with chain-wheel operator on each gear box shaft; with chain loops terminated 24 inches (600 mm) above floor.
6. Operation: Manual, with crank-type operator on each gear box shaft, with removable crank. Where necessary, extend crankshaft with universal joints and support brackets to a suitable

crank-mounting location not more than 44 inches (1115 mm) above floor, with an oil-encased miter gear box.

7. Operation: Electric, with factory-assembled electric operator designed for operating windows of type, size, weight, construction, use, and operating frequency indicated.
   a. Electric Operator: Provide operating system complying with NFPA 70; of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended in writing by window manufacturer; complete with operating system indicated, electric motor and factory-prewired motor controls with limit switches,remote-remote-control stations, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
      1) Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
      2) Electric Motor: Comply with NEMA MG 1; with thermal-overload protection; sized to start and operate size and weight of window sash ventilators under any conditions; one per each gear box shaft.
         a) Motor Characteristics: Single phase, sized by electric operator manufacturer, 60 Hz.
      3) Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure and momentary-contact, single push-button-operated control **OR** three-position, push-button-operated control with open, close, and stop functions, **as directed**.
      4) Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop sash ventilators at fully opened and fully closed positions.

F. Insect Screens
   1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.
      a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.
      b. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
   2. Stainless-Steel Insect Screen Frames: Fabricate frames of nonmagnetic stainless-steel members of 0.020-inch (0.5-mm) minimum wall thickness, with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, and removable PVC spline/anchor concealing edge of frame. Finish frames with No. 2B, bright mill finish.
   3. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
      a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
      b. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.040-inch (1.0-mm) **OR** 0.050-inch (1.3-mm), **as directed**, wall thickness.
      c. Finish: Match aluminum window members.
      d. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
      e. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
      f. Finish: Manufacturer's standard.
   4. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber

threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.
a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.

5. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
6. Copper Wire Fabric: 16-by-16 (1.3-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter copper wire.
7. Bronze Wire Fabric: 18-by-14 (1.2-by-1.6-mm) mesh of 0.009-inch- (0.23-mm-) **OR** 18-by-14 (1.13-by-1.5-mm) mesh of 0.011-inch- (0.28-mm-), **as directed**, diameter bronze wire with a clear varnish finish.
8. Stainless-Steel Wire Fabric: 18-by-14 (1.2-by-1.6-mm) mesh of 0.009-inch- (0.23-mm-) **OR** 18-by-16 (1.2-by-1.4-mm) mesh of 0.009-inch- (0.23-mm-) **OR** 18-by-16 (1.13-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-), **as directed**, diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI.
9. Solar-Screening Mesh Fabric: 17-by-15 (0.86-by-1.1-mm) **OR** 40-by-40 (0.3-by-0.3-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656.
10. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.

G. Accessories
1. Integral Ventilating System/Device: Where indicated, provide weather-stripped, adjustable, horizontal fresh-air vent, with a free airflow slot, full width of window sash by approximately 1 inch (25 mm) **OR** 3 inches (75 mm), **as directed**, when open, complying with AAMA/WDMA 101/I.S.2/NAFS. Equip vent bar with an integral insect screen, removable for cleaning.
2. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.
a. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.
3. Integral Louver Blinds: Provide remotely operated horizontal louver blinds in the space between two panes of glass. Construct blinds of aluminum slats, approximately 1 inch (25 mm) wide, with polyester fiber cords, equipped for tilting, raising, and lowering by standard operating hardware located on inside face of sash.
4. Exterior Louver Units: Manually adjustable, extruded-aluminum, solar-shade louver units; of type recommended by manufacturer for application over operable or fixed windows. Provide main extrusion members of 0.062-inch (1.6-mm) minimum wall thickness.
a. Operator: Crank-type gang operator, operable from inside building, designed to rotate louver blades simultaneously at least 80 degrees and to lock units in closed position; one operator per each louver unit. Form unit framing or mounting without interfering with insect screens.

H. Fabrication
1. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
2. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
3. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
a. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.

b. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
c. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.

4. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
   a. Horizontal-Sliding Windows: Provide operable sash with a double row of sliding weather stripping in horizontal rails and single- or double-row weather stripping in meeting or jamb stiles, as required to meet specified performance requirements. Provide compression-type weather stripping at perimeter of each movable panel where sliding-type weather stripping is not appropriate.
   b. Vertically Pivoted Windows: Provide double-row weather stripping.
5. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
6. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
7. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
8. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
9. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
10. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

I. Finishes, General
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Aluminum Finishes
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
3. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

5. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
6. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
   a. Organic Coating: Thermosetting, modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
   b. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
7. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 50 **OR** 70, **as directed**, percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 **OR** AAMA 2605, **as directed**, and with coating and resin manufacturers' written instructions.
8. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
   a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
4. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
5. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
6. Connect automatic operators to building electrical system.

B. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
   a. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
2. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   a. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A **OR** B, **as directed**, by applying same

test pressures required to determine compliance with AAMA/WDMA 101/I.S.2/NAFS in Part 1 "Performance Requirements" Article.

b. Testing Extent: Three windows as selected by the Owner and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.

c. Test Reports: Shall be prepared according to AAMA 502.

3. Remove and replace noncomplying aluminum window and retest as specified above.

4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Adjusting, Cleaning, And Protection

1. Adjust operating sashes and ventilators, screens, hardware, operators, **as directed**, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

2. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 51 13 00

SECTION 08 51 13 00a - ALUMINUM REPLACEMENT WINDOWS

DESCRIPTION OF WORK

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

GENERAL

Definitions

1. Window Types: ANSI/AAMA 101.
   a. Horizontal Slider (HS): Primary horizontally operating window.
   b. Single Hung (SH): Primary vertically operating window with only one operable sash.
   c. Double Hung (DH): Primary vertically operating window with two operable sashes.
   d. Thermally Improved: Primary window with thermal break between interior and exterior metal surfaces both at frame and sash or panel members.
      1) Single Window Construction: Provide insulating glass.
      2) Thermally improved aluminum windows may use members with thermal breaks or be of dual window construction (i.e.. primary-secondary (storm) or primary-primary).
   e. Dual Window Construction (DW):
      1) Primary-Secondary: Primary window with either interior or exterior secondary (storm) window.
      2) Primary-Primary: Combination of two primary windows employing common frame.
2. Type of Stainless Steel Screens (Frames and Screening): Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
3. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

System Description

4. Performance Requirements: Comply with following:
   a. Aluminum Replacement Windows: HUD UM 39a.
   b. Aluminum Replacement Windows: ANSI/AAMA 101 (Including test size requirements):
      1) Horizontal Sliding Windows: HS C35.
         a) Water Resistance: ASTM E 547, no leakage at 251.4 Pa (5.25 PSF) test pressure.
      2) Single Hung and Double Hung Windows: DH C35.
         a) Water Resistance: ASTM E 547, no leakage at 251.4 Pa (5.25 PSF) test pressure.
      3) Single Hung and Double Hung Windows: DH C45.
         a) Water Resistance: ASTM E 547, no leakage at 323.4 Pa (6.75 PSF) test pressure.
      4) Air Infiltration: ASTM E 283, Not exceed 0.049 cu m/s/mm (0.34 CFM/ft) of crack length of operable sash at 75 Pa (1.57 PSF) test pressure.
      5) Dual Window Construction: DW.
   c. Aluminum Replacement Windows: ASTM F 588, Annex AI, forced entry resistance performance level 10.
   d. Thermally Improved Windows: AAMA 1504:

1) Thermal Transmittance (U-Value): Maximum U70, 3.97 W/sq. m C (0.70 BTU/HR.FT.F) if not otherwise scheduled.
2) Condensation Resistance Factor (CRF): Minimum CRF C50 if not otherwise scheduled.

e. Sealed Insulating Glass: Tested and certified in accordance with HUD UM 82 complying with ASTM E 774, Class C.

Submittals

5. Product Data:
6. Shop Drawings:
   a. Include window elevations, installation details, anchorage details, clearance between frame and rough opening, hardware, glazing, and accessories.
7. Samples: Submit full set of finish color samples for color selection.
   a. For Supply and Deliver Only Contract: Submit one full size sample of each type of aluminum replacement window with specified finish for acceptance. Include sample of trickle ventilator.
8. Quality Assurance/Control Submittals:
   a. Certificates: Manufacturer's written third party certification that aluminum windows meet or exceed HUD UM 39a. HUD 82, and ANSI/AAMA 101 and other specified requirements.
   b. Manufacturer's installation instructions.
9. Closeout Submittals
   a. Operation and maintenance data.
   b. Special warranty.

Quality Assurance

10. Regulatory Requirements:
    a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
    b. Egress Requirements: Comply with applicable codes and regulations.
    c. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
    d. Accessibility:
       1) Architectural Barriers Act of 1968 as amended (42 USC 4151-4157) and HUD implementing regulations (24 CFR Part 40).
          a) Uniform Federal Accessibility Standards (UFAS).
       2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
       3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
       4) Americans with Disabilities Act of 1990 (ADA) (42 USC §§ 12101, et seq.) and implementing regulations (28 CFR Part 35).
11. Certifications: Comply with HUD UM 39a, HUD UM 82, ANSI Z34.1 and HUD 24 CFR 200.935.
12. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of aluminum replacement window with specified finish for acceptance.
    a. Location
    b. Approved Mock-up: Standard for rest of work.
    c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

13. Packing. Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
    a. Aluminum Replacement Windows: Label in accordance with HUD UM 39a attached signifying compliance with ANSI/AAMA 101 performance requirements.
    b. Thermally Improved Windows: Label in accordance with HUD UM 39a attached signifying compliance with specified AAMA 1504 performance requirements.
14. Acceptance at Site: Inspect aluminum replacement windows upon delivery. Replace damaged or defective materials before installation.

15. Storage and Protection: Store aluminum replacement windows in manner to protect from weather and other damage.

Project Conditions

16. Field Measurements: Field measure openings for aluminum replacement windows before start of fabrication.

Scheduling And Sequencing

17. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

18. Special Warranty: Provide one year written covering materials and installation for aluminum replacement windows.
    a. Warranty: Include coverage of inserts, hardware, and latches.
        1) Screening and glazing not included.
        2) Defects resulting from vandalism not included.
    b. For Supply and Delivery Only Contract:
        1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
        2) Contractor: Agrees to supply and deliver free of charge, complete replacement window, when defective part or parts cannot be installed without use of special tools.
    c. For Supply and Install Contract:
        1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement window.

PRODUCTS

Aluminum Replacement Windows

19. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors and equipment.

Materials

20. Aluminum Materials:
    a. Extruded Aluminum: ASTM B 221, Alloy 6063-T5 or stronger.
    b. Aluminum Alloys: Commercial quality and of proper alloy for window construction, free from defects impairing strength and/or durability.
        1) Wrought Aluminum Alloys: Alloying Elements: ANSI/AAMA 101.
    c. Window Members, Including Muntins: Aluminum except as allowed by ANSI/AAMA 101.
        1) Sill Members: Minimum 2.0 mm (0.078 inch) thick.
    d. Interlocks and mating fins may vary by tapering at maximum projected distance of 8 mm (5/16 inch) from edge.
        1) Other appendages may taper providing design results in net area of at least that calculated by using prescribed wall thickness for appendage length.
    e. Edge or Corner: May be eased with radius not to exceed wall thickness permitted for member.
    f. Glazing Legs, Channels or Glazing Bead Retainers, Serrated or Not: Minimum 1.3 mm (0.050 inch) thick for distance of not more than 13 mm (1/2 inch) each leg.
21. Other Metal Materials:
    a. Carbon Steel (reinforcing members): ASTM A 36, zinc coated in accordance with ASTM B 633 or cadmium coated in accordance with ASTM B 766.
    b. Stainless Steel: ASTM A 167, Type 302.
    c. Welding Filler Rods: AWS A5.3.
22. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
    a. Glass: ASTM C 1036, Type 1, Class 1, Glazing B Quality.
    b. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.

c. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
   1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
   2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
   3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
   4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.

d. Insulating Glass Units: HUD UM 82 and ASTM E 774, Class CBA.

e. Glass Thickness: Determined in accordance with ANSI/AAMA 101 Appendix, minimum 3 mm (1/8 inch) (DS).
   1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.

f. Glass: Labeled to show name of manufacturer and type.

23. Glazing Materials: Particularly suited for use with aluminum and not require painting.
   a. Make adequate provisions for use of glazing compound, if applicable.
   b. Remove material from glazing surfaces to which glazing compound will not readily adhere.
   c. Windows: May be either factory or field glazed by either channel-type gaskets or back-bedding materials.
   d. Glazing Clips: Not required when face stops are used.

24. Glazing Beads or Retainers: Material compatible with aluminum, and 6 required to retain glass, of sufficient strength and fixation to serve this purpose.
   a. Thickness of Glazing Beads: Optional except as otherwise specified.

25. Screens: Provide windows with screens as indicated, specified, or scheduled in manufacturer's standard approved design, applicable to specific aluminum windows.
   a. Screen Frames: Extruded aluminum frames of suitable alloy and of sufficient rigidity, crossbraces, as required, to lie flat against window and to prevent excessive bow in frame members and sag in screening.
      1) Frame Corners: Firmly joined in secure and rigid manner.
      2) Screen Spline: Aluminum or a material compatible with aluminum.
   b. Screening: One of following as indicated, specified, or scheduled:
      1) Vinyl Coated Fibrous Glass Yam: ASTM D 3656, Class 1, 18 by 16 mesh, 0.29 mm (0.0115 inch) diameter yam.
      2) Polyvinylidene Chloride or Polypropylene Filament: FS L-S-12513, Type I or III, Class 1 or 2, 18 by 18 mesh, 0.31 mm (0.012 inch) or 0.38 mm (0.015 inch) diameter filament.
      3) Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) diameter wire.
      4) Stainless Steel: Type 304 stainless steel:
         a) Medium: ANSI/SMA 6001 Medium Type, 12 x 12 mesh 0.58 mm (0.023 inch) diameter wire.
         b) Heavy: ANSI/SMA 6001 Heavy Type, 12 x 12 mesh 0.71 mm (0.028 inch) diameter wire, high tensile strength.
         c) Screen Frames: ANSI/SMA 6001 performance requirements, minimum 1.6 mm (0.062 inch) aluminum extruded 6063-T5 alloy designed to accept stainless steel wire cloth.
         d) Emergency Egress Windows: Design screen to be opened from interior only (to allow for egress to exterior).
   c. Screening: Fastened to frame in manner to permit replacement of screening.
   d. Screens: Provide with fastening devices, suited particularly for application to specific window made of aluminum or materials compatible with aluminum and of sufficient strength to perform satisfactorily.
   e. Assembled Screen with Insect Screening and Spline in Place: Outside dimension as measured from midpoint of opposite framing members shall not vary more than 4.8 mm (3/16 Inch) from outside dimension as measured at extreme ends of framing members.

f. Screens: Comply with applicable fire codes for egress and fireman access.
   1) Provide single point release as and where required by applicable codes and regulations.
   2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.
g. Window Screens: Include warning label indicating that screen will not stop child from falling out of window in accordance with SMA 7001.

Accessories

26. Hardware: Designed to perform functions for which it is intended and securely attached to window.
27. Thermal Break Material: Urethane, PVC, ISP, vinyl, or other material suitable for application that is compatible with aluminum.
28. Fasteners: Comply with ANSI/AAMA 101.
29. Panning and Receptor Systems: Extruded aluminum designed to fit existing openings, to receive windows, and to withstand wind forces as required by applicable codes and regulation.
    a. Exterior Trim System: Designed to withstand expansion/contraction forces of trim material.
    b. Interior Snap Trim: Provide manufacturer's standard interior trim package.
    c. Extruded Aluminum Minimum Thickness: 1.57 mm (0.062 inches).
30. Thermal Insulation: Unfaced fiberglass batt insulation in accordance with ASTM C 665, Type 1.
    a. Vapor Barrier: ASTM D 4397, 4 mil polyethylene sheeting with pressure sensitive adhesive sealing tape.
31. Joint Sealants:
    a. Exterior Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.
    b. Back-up Material: Standard preformed and precompressed foam material, round rod or semi-circular type, permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and with sealant.
       1) Materials impregnated with oil, solvents, or bituminous materials not allowed.
       2) Provide type as recommended by sealant manufacturer for particular installation.
       3) Material: Neoprene, butyl, polyurethane, vinyl, or polyethylene rod.
    c. Interior Joint Sealant: ASTM C 834, latex acrylic.

Fabrication

32. Windows: Assembled in secure manner to perform as specified and to provide neat, weather tight construction.
    a. Make permanent watertight joints at junctions of sill and jamb members.
    b. Joint Sealant at Mechanically Fixed Joints: AAMA 800, Type 803.3.
    c. Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
33. Mullions and Structural Members: Mullion (whether joined by integral mullions, independent mullions, or by combination of frame members): Capable of withstanding load outlined under Uniform Load in ANSI/AAMA 101, Section 2 without deflecting more than 1/175th of its span.
34. Fin Trim or Installation Fins: Aluminum or other suitable material compatible with aluminum and of sufficient strength and thickness to assure satisfactory installation.
    a. Nailing grooves and/or break off score lines in extrusions are acceptable.
    b. Applied fins or fin trim may be assembled to windows by interlocking with frame members or with fasteners located not over 400 mm (16 inches) OC.
35. Thermally Improved Windows: Single window construction with thermal breaks and insulating glass units or dual window construction.
    a. Thermal Break in Two Frame or One Frame Windows: Not bridged by any screws, fasteners, panning, etc., that would allow excessive heat transfer through window frame.
    b. Do not make structural connection in loading bearing member into thermal break material.
36. Sills: Provide weep holes in sill of glazing pocket to provide means for water to flow to exterior.
37. Trickle Ventilators: Type which fits within glazing channels of sash frame, and contains gasketed channel to accept sealed insulating glass used in window sash.

a. Ventilator: Installed in top rail of upper sash, accurately sized to extend full width of sash, properly fit sash, and sash frame above and insulating glass below.
b. Ventilator: Consist of two piece aluminum housing connected by, and separated by, PVC extrusion forming thermal break.
c. Gasketed Shutter: Operate Internal flap to open and close ventilator.
d. Unit: Complete with fly-screen.
e. Color: Selected from manufacturers standard colors.

38. Secondary Windows (Storm Windows): Comply with Division 8 Section “Aluminum Storm Windows.”
39. Windows: Comply with applicable fire codes for egress.

Finishes

40. Finish:
    a. Aluminum: Provide one of following finishes as specified or scheduled:
        1) Pigmented Organic Coating: Factory applied pigmented organic coating, AAMA 603.8.
            a) Color: As selected from manufacturers standard colors.
        2) High Performance Organic Coating: Factory applied pigmented organic coating, AAMA 605.2.
            a) Color: As selected from manufacturer's standard colors.
        3) Color Anodized: Factory applied anodic coating, AAMA 608.1, Class 1.
            a) Color: As scheduled.
        4) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
    b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
    c. Dress and finish exposed welded joints.
41. Protective Coatings:
    a. Steel Subframes: Insulate surfaces of steel from direct contact with aluminum surfaces by heavy coat or alkali-resistant bituminous paint or zinc-chromate prime coat, or other coating suitable for this purpose.
    b. Wood Subframes: Properly treat with preservative which will not promote corrosion of aluminum.
    c. Steel or Wood Subframes: Do not leave exposed on exterior of building.

Source Quality Control

42. Fabrication Tolerances: Wall Thickness, Cross-sectional Size and Overall Size: In accordance with ANSI/AAMA 101.
43. Testing: Performed under Third Party Administrator who is in compliance with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION

Examination

44. Site Verification of Conditions:
    a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
    b. Existing Conditions: Examine openings before beginning installation.
    c. Do not proceed with installation until conditions are satisfactory.

Preparation

45. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
    a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
    b. Adequately enclose and protect against weather any interior space where installation is incomplete at end of working day.

c. Repair or replace damaged elements in accordance with Detailed Scope of Work.

46. Existing Widows: Remove existing windows and debris from site in accordance with Detailed Scope of Work.
47. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.
    a. Existing Window Jambs: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new windows.
    b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

48. General: Install In accordance with ASTM E 737 except as modified by ANSI/AAMA 101 Appendix, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
    a. Securely fasten windows in place to straight, plumb and level condition, without distortion of window or window frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
    b. Make proper allowance for expansion/contraction movement of aluminum.
    c. Panning and Receptor Systems: Install to ensure watertight seal at joints with existing opening and with new replacement window.
        1) Thermal Insulation: Fill voids in panning system with thermal insulation.
        2) Vapor Barrier: Apply vapor barrier on inside between panning and existing opening. Seal laps and terminations with pressure sensitive tape.
    d. Comply with applicable codes and regulations regarding egress requirements and fireman entry.
49. Joint Sealants: Apply in accordance with manufacturers recommendations.
    a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing calking and joint sealants from areas to receive new joint sealant.
    b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
    c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
    d. Seal joints between perimeter of window frame and underlying or surrounding construction at
    e. Exterior and interior with joint sealant to accomplish weather-tight installation. Maximum Width of Sealed Joint: 13 mm (1/2 inch).
50. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration and galvanic action.
    a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape. or gasket between surfaces.
    b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Field Ouality Control

51. Owners Field Testing: the Owner may have field testing of windows conducted by its own testing agency in accordance with AAMA 502.
    a. Tests: May include, but not limited to:
        1) Field Testing (Hose Test) for Water Leakage: AAMA 501.2.
        2) Field Testing (Air Pressure Difference) for Water Leakage: AAMA 502, Test Method B.
            a) Field Testing for Air Leakage: ASTM E 783.
            b) Field Testing for Water Determination: ASTM E 1105.
    b. Test Pressures: Comply with specified performance requirements.
    c. Contractor: Provide incidental labor facilities necessary to facilitate inspections and tests.
    d. Costs of Testing:
        1) By the Owner: Successful initial tests.

2) By Contractor: Initial tests with failures and subsequent tests as required because of test failures. Costs shall include costs of the Owner and other consultants for observations of tests and corrective work.

e. Corrective Measures: Meet standards of quality of specified window and subject to acceptance of the Owner.

Adjusting And Cleaning

52. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave windows and hardware in proper operating condition.
53. Cleaning: Comply with requirements of Detailed Scope of Work.
    a. Clean windows after installation is completed to remove foreign matter and surface blemishes.
    b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

54. Installed Work: Protect windows from damage after installation.

END OF SECTION 08 51 13 00a

Task	Specification	Specification Description
08 51 19 00	01 22 16 00	No Specification Required

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SECTION 08 51 23 00 - STEEL WINDOWS

1.1 GENERAL

A. Description Of Work

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

B. Summary

1. Section Includes:
   a. Steel windows from hot-rolled sections.
   b. Steel windows from cold-formed steel members.

C. Performance Requirements

1. Structural Performance: Provide steel windows capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing windows that are representative of those specified according to ASTM E 330 or structural calculations:
   a. Design Wind Loads: Determine design wind loads under conditions indicated according to ASCE/SEI 7.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
      2) Importance Factor.
      3) Exposure Category: B **OR** C **OR** D, **as directed**.
   b. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressures.
2. Windborne-Debris Resistance: Provide glazed steel windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed steel windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.
3. Condensation-Resistance: Provide steel windows with a CRF when tested according to AAMA 1503 **OR** CR determined according to NFRC 500, **as directed**, of 36 **OR** 40, **as directed**, minimum.
4. Thermal Transmittance: Provide steel windows with the maximum whole-fenestration product U-factor indicated, when tested according to AAMA 1503 **OR** determined according to ASTM E 1423 **OR** determined according to NFRC 100, **as directed**.
   a. U-Factor: 0.49 Btu/sq. ft. x h x deg F **OR** 2.8 W/sq. m x K, **as directed**.
5. Solar Heat-Gain Coefficient (SHGC): Provide steel windows with a maximum whole-fenestration product SHGC of 0.40 **OR** 0.55, **as directed**, determined according to NFRC 200.
6. Air Infiltration for Weather-Stripped Ventilators: Not more than 0.37 cfm/ft. (0.18 L/s per m) of ventilator crack length at an inward test pressure of 6.24 lbf/sq. ft. (298 Pa) when tested according to ASTM E 283.
7. Air Infiltration for Non-Weather-Stripped Ventilators: Not more than 1.0 cfm/ft. (0.47 L/s per m) of ventilator crack length at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) when tested according to ASTM E 283.
8. Water Penetration: No leakage for 15 minutes when window is subjected to a rate of flow of 5 gal./h per sq. ft. (0.05 L/s per sq. m) with a differential pressure across the window of 2.86 lbf/sq. ft. (137 Pa) **OR** 6.24 lbf/sq. ft. (298 Pa), **as directed**, when tested according to ASTM E 331.
9. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.
10. Crack Tolerances: Test each type and size of required window unit, with ventilators closed and locked, for compliance with the following tolerances:

a. Casement Windows: It shall not be possible to freely insert a steel feeler gage 2 inches (51 mm) wide by 0.020 inch (0.5 mm) thick between more than 40 percent of the inside metal-to-metal contacts between frames and ventilators without forcing.
b. Projected Windows: It shall not be possible to freely insert a steel feeler gage 2 inches (51 mm) wide by 0.031 inch (0.8 mm) thick between the inside metal-to-metal contacts between frames and ventilators without forcing, or to freely insert a steel feeler gage 2 inches (51 mm) wide by 0.020 inch (0.5 mm) thick between more than 40 percent of such contacts between frames and ventilators without forcing.

11. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

D. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
a. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. LEED Submittal:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
a. Mullion details including reinforcement and stiffeners.
b. Joinery details.
c. Expansion provisions.
d. Flashing and drainage details.
e. Weather-stripping details.
f. Glazing details.
g. Window-cleaning provisions.
h. Window System Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
i. Wiring Diagrams: Power, signal, and control wiring.
j. Accessories.
4. Samples: For steel windows and components required, prepared on Samples of size indicated below:
a. Main Framing Member: 12-inch- (300-mm-) long, full-sized sections, with glazing bead, weather stripping and factory-applied color finish.
b. Hardware: Full-size units with factory-applied finish.
5. Product Schedule: For steel windows. Use same designations indicated on Drawings.
6. Delegated-Design Submittal: For steel windows indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
7. Qualification Data: For qualified Installer, manufacturer, professional engineer and testing agency.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for steel windows.
9. Field quality-control reports.
10. Operation and Maintenance Data: For operable window sash, operable hardware, operable fire-rated window hardware, window system operators, weather stripping and finishes to include in operation and maintenance manuals.
11. Warranties: Sample of special warranty.

E. Quality Assurance
1. Manufacturer Qualifications: A manufacturer capable of fabricating steel windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists, and by labels, test reports, and calculations.
2. Installer Qualifications: An installer acceptable to window manufacturer for installation of units required for this Project.
a. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for steel windows, including Shop Drawings and Designated Design Submittal based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Source Limitations: Obtain steel windows from single source from single manufacturer.
4. Fire-Test-Response Characteristics: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated on Drawings, based on testing indicated.
a. Neutral-Pressure Test: NFPA 257 **OR** UL 9, **as directed**.
OR
Positive-Pressure Test: ASTM E 2010 **OR** NFPA 257 **OR** UBC 7-4 **OR** UL 9, **as directed**.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. SWI Publication: Comply with applicable requirements in SWI's "The Architect's Guide to Steel Windows and Doors" except where more stringent requirements are indicated.
7. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions
1. Field Measurements: Verify actual dimensions of steel window openings by field measurements before fabrication.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.
a. Failures include, but are not limited to, the following:
1) Failure to meet performance requirements.
2) Structural failures including excessive deflection.
3) Water leakage or air infiltration.
4) Faulty operation of operable sash and hardware.
5) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
b. Warranty Period: Two **OR** Three, **as directed**, years from date of Final Completion.
c. Warranty Period for Metal Finishes: Five **OR** 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of steel windows.
a. Exposed Fasteners: If exposed fasteners are used, provide Phillips flat-head machined screws that match finish of member or hardware being fastened, as appropriate.
2. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A 123/A 123M. Provide units with sufficient strength to withstand design pressure indicated.

3. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when steel window is closed.
   a. Weather-Stripping Material: Elastomeric, cellular, preformed gaskets complying with ASTM C 509.
      OR
      Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
      OR
      Weather-Stripping Material: Manufacturer's standard.
4. Sliding-Type Weather Stripping: Provide manufacturer's standard woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric.
   a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.
5. Trim Members, Screen Frames, Retainers for Weather Stripping, Flashing, and Similar Items: Extruded aluminum **OR** Formed sheet aluminum **OR** Stainless steel **OR** Formed steel **OR** Manufacturer's standard, **as directed**.
6. Glazing Stops: Extruded aluminum **OR** Formed sheet aluminum **OR** Stainless steel **OR** Formed steel **OR** Manufacturer's standard, **as directed**.
7. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

B. Window
1. Window Type: Casement **OR** Double hung **OR** Fixed **OR** Horizontally pivoted **OR** Horizontal sliding **OR** Projected **OR** Single hung **OR** Vertically pivoted **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
2. Hot-Rolled Steel Window Members: Provide frame and ventilator members formed from hot-rolled, new billet steel sections. For combined weight of frame and ventilator members and front-to-back depth of frame or ventilator members, comply with the following requirements:
   a. Light Intermediate Windows: Not less than 2.0 lb/ft. (2.98 kg/m) in combined weight and not less than 1 inch (25.4 mm) deep.
   b. Standard Intermediate Windows: Not less than 3.0 lb/ft. (4.46 kg/m) in combined weight and not less than 1-1/4 inches (32 mm) deep.
   c. Heavy Intermediate Windows: Not less than 3.5 lb/ft. (5.21 kg/m) in combined weight and not less than 1-5/16 inches (33.34 mm) deep.
   d. Heavy Custom Windows: Not less than 4.2 lb/ft. (6.25 kg/m) in combined weight and not less than 1-1/2 inches (38.1 mm) deep.
      1) Dimensions of Projected Frame and Ventilator Members: Nominally 1/8 inch (3 mm) thick by 1-3/8 inches (35 mm) deep except members nominally 1-1/4 inches (32 mm) deep may be used provided corners are welded and ground.
      2) Applied Weather Stripping: Where indicated, 0.074-inch (1.9-mm) **OR** 0.060-inch (1.5-mm), **as directed**, minimum thickness.
   e. Window Finish: Galvanized **OR** Galvanized and factory primed **OR** Factory primed **OR** Baked enamel **OR** Powder coat **OR** High performance, organic, **as directed**.
      1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
3. Cold-Formed Steel Window Members: Provide frame and ventilator members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653/A 653M. For combined weight of frame and ventilator members and front-to-back depth of frame or ventilator members, comply with the following requirements:
   a. Commercial and Industrial Windows: Not less than 2.75 lb/ft. (4.09 kg/m) in combined weight, and not less than 1-1/4 inches (32 mm) deep.
   b. Window Finish: Baked enamel **OR** Powder coat, **as directed**.
      1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

C. Glazing
1. Glass and Glazing System: See Division 08 Section "Glazing" for glass units and glazing requirements for steel windows.

D. Hardware
1. General: Provide manufacturer's standard nonremovable, **as directed**, solid bronze **OR** malleable iron **OR** die-cast metal, **as directed**, hardware, with operating components of stainless steel, carbon steel complying with AAMA 907, brass, bronze, or other corrosion-resistant material designed to operate smoothly, to close tightly, and to lock steel window ventilators securely. Provide hardware of sufficient strength to accommodate size and weight of ventilator for which it is intended.
2. Sill Cap/Track: Designed to comply with performance requirements indicated and to drain to the exterior.
3. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and to operate from the inside only.
4. Roller Assemblies: Low-friction design.
5. Friction Shoes: Adjustable friction shoes of bronze, brass, nylon, or other nonabrasive, nonstaining, noncorrosive, durable material.
6. Hinges: Four-bar friction hinges complying with AAMA 904.
7. Limit Device: Provide concealed friction adjustor/stay-bar **OR** friction adjustor/stay-bar with release key or tool **OR** support arms with adjustable, limited hold-open, **as directed**, limit devices designed to restrict sash or ventilator opening.
8. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
   a. Operator shall operate all ventilators simultaneously, securely closing them at both jambs without use of additional manually controlled locking devices.
9. Pole Operators: Tubular-shaped, anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; one pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.
10. Casement Windows: Provide the following operating hardware:
    a. Operating Device: Gear-type rotary operator located on the jamb at the sill.
       OR
       Operating Device: Combination lever-handle and cam-type latch.
    b. Hinges: Concealed, four-bar friction hinges with adjustable slide shoes; two per ventilator.
       OR
       Hinges: Heavy duty, three-knuckle butt hinges with nylon bushings; two per ventilator.
       OR
       Hinges: Provide standard-duty, concealed, four-bar friction egress hinges with adjustable slide shoes; two per ventilator where indicated. Provide hinge designed to achieve 90-degree ventilator opening.
       OR
       Hinges: Extension hinges or pivots, nonfriction type; two per ventilator.
    c. Lock: Lift-type, cam-action lock.
    d. Limit Device: Stay bar with an adjustable hold-open device.
11. Double **OR** Single, **as directed**,-Hung Windows: Provide the following operating hardware:
    a. Sash Balances: Two per sash.
    b. Counterbalance and Pulley: Two per sash to operate ventilators in unison with stainless-steel-cable sash cord.
       1) Single-Hung Upper Sash Retainer: Manufacturer's standard.
    c. Self-Closing Device for Single-Hung, Fire-Rated Windows: Fusible link **OR** Electrically operated, resettable thermal link, labeled and tested per UL 33, **as directed**.
    d. Handle(s): Lift **OR** Pull-down, **as directed**, handle; one **OR** two, **as directed**, per sash.
    e. Lock: Cam-action sweep lock and keeper on meeting rail; one **OR** two, **as directed**, per sash.
12. Horizontal-Sliding Windows: Provide the following operating hardware:

a. Rollers: Steel, lubricated, ball-bearing rollers.
b. Lock: Manufacturer's standard.
c. Limit Device: Manufacturer's standard.
d. Pull Handle: Manufacturer's standard.
e. Automatic Closer for Fire-Rated Steel Sash: Heat- **OR** Heat- and electrically, **as directed**, activated spring-driven closer.

13. Pivoting Windows: Provide the following operating hardware:
    a. Pivot Assembly: Manganese-bronze pivot assembly designed for center **OR** off-center, **as directed**, axis pivoting.
    b. Lock: Internal, key-operated, limited-access locks; one **OR** two, **as directed**, per jamb.
        1) Bronze safety drop bolts.
        2) Bronze cam fasteners.
    c. Limit device.
14. Projected Windows: Provide the following operating hardware:
    a. Operating Device: Gear-type rotary **OR** Push-bar-type, **as directed**, underscreen, **as directed**, ventilator operator located at the sill.
    b. Hinges: Concealed, four-bar friction hinges with adjustable slide shoes; two per ventilator.
    OR
    Hinges: Balance arms with adjustable, nonabrasive friction pivots; two per ventilator.
    OR
    Hinges: Balance arms with adjustable, nonabrasive friction shoes; two per ventilator.
        1) Provide ventilator operation that permits cleaning of the outside glass face from the interior.
        2) Provide jamb-mounted, sliding, brass friction shoes with screw adjusters.
    c. Lock: Cam-action, sweep lock handle with surface-mounted strike.
    OR
    Lock: Key-operated security lock and keeper.
    OR
    Lock: Pole-operated, spring catch lock.
    OR
    Lock: Pole-operated, cam-action, sweep lock handle and keeper.

E. Group Window Operating Systems
1. Provide window operating system for window groups as indicated. Coordinate operating system design with window fabrication and hardware selections to ensure smooth, durable operation of ventilators.
2. Operation Function: All ventilators move simultaneously and close securely at sash frames without using additional manually controlled locking devices.
3. Operating System: Complete with shafts, brackets, levers, rods, oil-encased gear boxes, and standard fittings and accessories for operation indicated.
    a. Rack-and-Pinion Operating System: Torsion-type with steel pipe torsion shaft and factory-sealed, oil-encased gear box. Provide system with rack-and-pinion sets and operating arms. Provide standard fittings and accessories for operation indicated. Space support bearings at 10 feet (3 m) o.c. maximum.
        1) Space operating arms not more than 60 inches (1500 mm) o.c.
        2) Provide one operating arm for each operating vent.
    b. Horizontal-Movement Operating System: Tension-type with steel rod or cable transmission lines operating in conduit between ventilator operators, factory-sealed lubricated rotary thrust unit, and toggle-type operator arms. Provide standard fittings and accessories for operation indicated. Provide support bracket at each operator, at bends, and not more than 10 feet (3 m) o.c. elsewhere.
        1) Space operating arms not more than 10 feet (3 m) o.c. along each continuous unit.
        2) Provide one operating arm for each operating vent.
4. Operation: Manual, with chain-wheel operator on each gear box shaft; with chain loops terminated 24 inches (600 mm) above floor.

OR

Operation: Manual, with crank-type operator on each gear box shaft; with removable crank and oil-enclosed miter gear box. Where necessary, extend crankshaft with universal joints and support brackets to a suitable crank-operator mounting location not more than 44 inches (1115 mm) above floor.

5. Operation: Electric, with factory-assembled electric operator designed for operating windows of type, size, weight, construction, use, and operating frequency indicated.
   a. Electric Operator: Provide operating system complying with NFPA 70; of size and capacity and with features, characteristics, and accessories suitable for Project conditions recommended in writing by window manufacturer; complete with operating system indicated, electric motor and factory-prewired motor controls with limit switches, remote-control stations, power disconnect switches, enclosures to protect controls and all operating parts, and accessories required for reliable operation. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
      1) Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
      2) Electric Motor: Comply with NEMA MG 1; with thermal-overload protection; sized to start and operate size and weight of window sash ventilators under any conditions; one per each gear-box shaft.
         a) Motor Characteristics: Single phase, sized by electric operator manufacturer, 60 Hz.
      3) Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure and momentary-contact, single push-button-operated control **OR** three-position, push-button-operated control with open, close, and stop functions, **as directed**.
      4) Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop sash ventilators at fully opened and fully closed positions.

F. Insect Screens
   1. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame, with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.
      a. Screen Frames: Fabricate frames of tubular-shaped, extruded- **OR** formed-, **as directed**, aluminum members of 0.04-inch (1.0-mm) minimum wall thickness.
         1) Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.

            OR

            Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.

            OR

            Finish: Manufacturer's standard.
      b. Screen Frames: Fabricate frames of tubular-shaped, nonmagnetic stainless-steel members of 0.02-inch (0.5-mm) minimum wall thickness.
         1) Finish: No. 2B bright mill finish **OR** Match steel window finish, **as directed**.
      c. Screen Frames (inside only): Fabricate frames of tubular-shaped, steel sheet members of 0.03-inch (0.8-mm) minimum wall thickness. Finish the frames to match window units.
   2. Glass-Fiber Mesh Fabric: ASTM D 3656, 18-by-14 or 18-by-16 **OR** 20-by-20 or 20-by-30, **as directed**, count per sq. in. (645 sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.
      a. Mesh Color: Gray.
   3. Aluminum Wire Fabric: 18-by-16 count per sq. in. (645 sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
      a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.

4. Copper Wire Fabric: 16-by-16 count per sq. in. (645 sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter copper wire.
5. Bronze Wire Fabric: 18-by-14 count per sq. in. (645 sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter bronze wire with a clear varnish finish.
6. Stainless-Steel Wire-Fabric: 18-by-16 **OR** 18-by-18, **as directed**, count per sq. in. (645 sq. mm) mesh of 0.009-inch- (0.2-mm-) minimum diameter, nonmagnetic stainless-steel wire, Type 304 or 316.
7. Solar-Screening Mesh Fabric: 17-by-15 **OR** 40-by-40, **as directed**, count per sq. in. (645 sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656.
8. Wickets: Provide sliding or hinged wickets, framed and trimmed for a tight fit and durability during handling.

G. Accessories
1. General: Provide manufacturer's standard accessories that comply with indicated standards.
2. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.
   a. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.

H. Fabrication
1. General: Fabricate steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
   a. Provide units that are reglazable without dismantling ventilator framing.
   b. Prepare window ventilators for site glazing **OR** factory glazing, **as directed**.
2. Mullions: Formed of hot-rolled **OR** cold-formed, **as directed**, steel matching window units; with anchors for support to structure and for installation of window units and having sufficient strength to withstand design pressure indicated. Provide mullions of profile indicated and with cover plates. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections.
3. Subframes and Operable Ventilators: Formed of hot-rolled **OR** cold-formed, **as directed**, steel of profile indicated. Miter or cope corners, and mechanically fasten and seal joints **OR** weld and dress joints smooth, **as directed**.
4. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.
5. Provide water-shed members above casement **OR** horizontal-sliding, **as directed**, ventilators.
6. Glazing Stops: Provide screw-applied **OR** snap-on, **as directed**, glazing stops; coordinate with Division 08 Section "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames. Finish glazing stops to match window units if fabricated of steel; otherwise, provide manufacturer's standard finish.
7. Glazing Clips: Where face glazing (without glazing stops) is indicated, furnish glazing clips for concealment in glazing compound.

I. Metallic-Coated Steel Sheet Finishes
1. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint complying with SSPC-Paint 20 and ASTM A 780.
2. Factory Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating

manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

J. Steel Finishes
1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" **OR** SSPC-SP 8, "Pickling", **as directed**. After cleaning, apply a conversion coating suited to the organic coating to be applied over it, **as directed**.
2. Galvanized Finish: Hot-dip galvanize per ASTM A 123.
3. Steel and Galvanized-Steel Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
4. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
5. High-Performance Organic Finish: Two-coat fluoropolymer finish containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1.3 EXECUTION

A. Examination
1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify rough opening dimensions, levelness of sill plate, accurate locations of connections to building electrical system, **as directed**, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
   a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   c. Metal Surfaces: Dry, clean, and free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
4. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.
5. Separate corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."

C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Tests and Inspections:

a. Testing Methodology: Testing of windows for air-penetration resistance and water resistance will be performed according to AAMA 502, Test Method A **OR** B, **as directed**, by applying same test pressures required for performance.
b. Testing Extent: Three windows as selected by the Owner and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.

3. Window will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports according to AAMA 502. Testing agency will interpret test results and state in each report whether tested work complies with or deviates from requirements.

D. Adjusting, Cleaning, And Protection
1. Adjust operating sashes and ventilators, screens, hardware, operators, **as directed**, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
2. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
3. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
5. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer's written recommendations.
6. Refinish or replace windows with damaged finish.

E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain group window operating system for steel windows.

END OF SECTION 08 51 23 00

SECTION 08 51 69 00 - ALUMINUM STORM WINDOWS

DESCRIPTION OF WORK

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

GENERAL

Definitions

1. Aluminum Storm Window Configuration and Performance Classes: ANSI/AAMA 1002.10:
   a. VWE (15): Vertically operating insulating storm window for external application, Performance Class 15.
   b. VWE (45): Vertically operating insulating storm window for external application, Performance Class 45.
   c. HWE (15): Horizontally operating insulating storm window for external application, Performance Class 15.
   d. FWE (15): Fixed removable insulating storm window for exterior application, Performance Class 15
   e. FWI (15): Fixed removable insulation window for internal application, Performance Class 15.
   f. HWI (15): Horizontally operating insulating window for internal application, Performance Class 15.
2. Type of Stainless Steel Screens (Frames and Screening): Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
3. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination Freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

System Desription

4. Performance Requirements: Comply with following:
   a. Storm Windows: HUD UM 39a.
   b. Storm Windows: ANSI/SMA 6001.
      1) Exterior Mounted Aluminum storm Windows for Normal Usage: Specification FWE, HWE, or VWE as applicable and Performance Class 15.
      2) Interior Mounted Aluminum Storm Windows for Normal Usage: Specification FWI, HWI, or VWI as applicable and Performance Class 15.
      3) High Rise Storm Windows: Specification VWE and Performance Class 45.

Submittals

5. Product Data.
6. Shop Drawings:
   a. Indicate fabrication of parts, metal thickness. installation details, fastening and sealing.
   b. Include sections of typical members and details of latching devices.
7. Samples: Submit full set of finish color samples for color selection.
   a. For Supply and Deliver Only Contract: Submit one full size sample of each type of storm window with specified finish for acceptance.
8. Quality Assurance/Control Submittals:
   a. Certificates: Manufacturer's written third party certification that storm windows meet or exceed HUD UM 39a, ANSI/AAMA 1102.10, and other specified requirements.
   b. Manufacturer's installation instructions.

9. Closeout Submittals:
    a. Operation and maintenance data.
    b. Special warranty.

Quality Assurance

10. Regulatory Requirements:
    a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
    b. Egress Requirements: Comply with applicable codes and regulations.
    c. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
    d. Accessibility:
        1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
            a) Uniform Federal Accessibility Standards (UFAS).
        2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
        3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
        4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
11. Certifications: Comply with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.
12. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of storm window with specified finish for acceptance.
    a. Location: As directed.
    b. Approved Mock-up: Standard for rest of work.
    c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

13. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
    a. Aluminum Storm Windows: Label in accordance with HUD UM 39a attached signifying compliance with ANSI/AAMA 1002.10 performance requirements.
14. Acceptance at Site: Inspect storm windows upon delivery. Replace damaged or defective materials before installation.
15. Storage and Protection: Store storm windows in manner to protect from weather and other damage.

Project Conditions

16. Field Measurements: Field measure openings for storm windows before start of fabrication.

Scheduling And Sequencing

17. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

18. Special Warranty: Provide one year written covering materials and installation for storm windows.
    a. Warranty: Include coverage of inserts, hardware, and latches.
        1) Screening and glazing riot included.
        2) Defects resulting from vandalism not included.
    b. For Supply and Delivery Only Contract:
        1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
        2) Contractor: Agrees to supply and deliver free of charge, complete replacement window, when defective part or parts cannot be installed without use of special tools.
    c. For Supply and Install Contract:
        1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement window.

PRODUCTS

Aluminum Storm Windows

19. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware. anchors, and equipment.
20. Materials: ANSI/AAMA 1002.10.
    a. Extruded Aluminum: ASTM B 221, Alloy 60630-TS or stronger.
    b. Carbon Steel (reinforcing members): ASTM A 36, zinc coated in accordance with ASTM B 633 or cadmium coated in accordance with ASTM B 766.
    c. Stainless Steel: ASTM A 167, Type 302.
    d. Anti-galling Devices: Manufacturers standard non-corrosive material compatible with aluminum.
    e. Channel Gaskets: Manufacturer's standard flexible vinyl.
    f. Welding Filler Rods: AWS A5.3.
21. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
    a. Glass: ASTM C 1036, Type 1. Class 1, Glazing B Quality.
    b. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.
    c. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
        1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
        2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
        3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
        4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
    d. Glass Thickness: Determined in accordance with ANSI/AAMA 1002.10 Appendix, minimum 3 mm (1/8 inch) (DS).
        1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
    e. Glass: Labeled to show name of manufacturer and type.
22. Insert Insect Screens: Provide storm windows with Screens as indicated, specified, or scheduled in manufacturer's standard approved design, applicable to specific storm windows.
    a. Screen Frames: Roll form aluminum frames of suitable alloy and of sufficient rigidity, crossbraces, as required, to lie flat against window and to prevent excessive bow in frame members and sag in screening.
        1) Frame Comers: Firmly joined in secured and rigid manner.
    b. Screening: One of following as indicated, specified, or scheduled:
        1) Vinyl Coated Fibrous Glass Yam: ASTM D 3656, Class 1, 18 by 16 mesh, 0.29 mm (0.0115 inch) diameter yam.
        2) Polyvinylidene Chloride or Polypropylene Filament: FS L-S-12513, Type I or III, Class 1 or 2, 18 by 18 mesh, 0.31 mm (0.012 inch) or 0.38 mm (0.015 inch) diameter filament.
        3) Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) diameter wire.
        4) Stainless Steel Medium: ANSI/SMA 6001 Medium Type, 12 x 12 mesh type 304 stainless steel 0.58 mm (0.023 inch) diameter wire.
        5) Stainless Steel Heavy: ANSI/SMA 6001 Heavy Type, 12 x 12 mesh type 304 high tensile strength stainless steel 0.71 mm (0.028 inch) diameter wire.
    c. Screening: Fastened to frame in manner to permit replacement of screening.
    d. Screens: Provide with fastening devices, suited particularly for application to specific window made of aluminum or materials compatible with aluminum and of sufficient strength to perform satisfactorily.
    e. Screens: Comply with applicable fire codes for egress and fireman access.
        1) Provide single point release as and where required by applicable codes and regulations.

2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.

f. Window Screens: Include warning label indicating that screen will not stop child from failing out of window in accordance with SMA 7001.

Accessories

23. Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.

Fabrication

24. General:
    a. Storm Windows: Conform to approved Shop Drawings.
    b. Storm Windows: Assembled securely to assure neat, weather resistant construction.
    c. Glazed Sash: Fabricated to permit reglazing without special tools.
    d. Remove flux and grind welds, flush with exposed surfaces, and polish to blend with ad surfaces.
    e. Sills: Provide weep holes to provide means for water to flow to exterior.
    f. Inserts:
        1) Removable to inside.
        2) Not operable or removable from outside when in closed and latched position.
        3) Glass Inserts: Weatherstripped to prevent metal-to-metal contact with main frame.
    g. Storm Windows: Comply with applicable fire codes for egress.
25. Vertically Sliding Storm Windows: Provide following features:
    a. Aluminum two-track or triple-track, self-storing, vertical-sliding combination storm and screen units with two glass insert panels and one screen insert panel, and two-track storm windows.
    b. Master Frame: Afford clearance for operation of prime window hardware.
    c. Equip units over 1 143 mm (45 inches) wide, 2 032 mm (80 inches) high or 3 175 mm (125 united inches) with extruded aluminum tie bar to ensure rigidity to main frame.
    d. Provide self-activating locks or latches designed to hold sash secure in locked and ventilating positions.
26. Horizontally Operating Storm Windows: Provide following features:
    a. Aluminum triple track, self-storing, horizontally operating, combination storm and screen unit.
    b. Glass Insert Panels: Operable and slide on rollers, rigid PVC or nylon glides.
    c. Equip with security lock to latch closed when in locked position.
    d. Master Frame: Afford clearance for operation of prime window hardware.
    e. Fixed Aluminum Vertical Tie Bar at Meeting Rails of Inserts: Ensure rigidity to main frame.
27. Fixed Picture Storm Windows: Provide following features:
    a. Divider on Storm Windows: Locate over meeting rail or prime window.
    b. When window is larger than 1500 mm (60 inches) in height or width, separate glass area into sections with one or more aluminum muntins to join pieces of glass.
    c. Picture Windows: Fixed but removable inserts either from inside or from outside.
        1) Glazing: Wrapped around marine type vinyl or drop in.

Finishes

28. Finish:
    a. Aluminum Finish: Provide one of following as specified or scheduled:
        1) Factory applied pigmented organic coating. AAMA 603-8.
            a) Color: As selected from manufacturer's standard colors.
        2) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
    b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
    c. Dress and finish exposed welded joints.

Source Quality Control

29. Testing: Performed under Third Party Administrator who is in compliance with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION

Examination

30. Site Verification of Conditions: indicated on Shop Drawings.
    a. Field Measurements: Verify field measurements are as
    b. Existing Conditions: Examine openings before beginning installation.
    c. Verify that surfaces to receive storm windows are clean.
    d. Do not proceed with installation until conditions are satisfactory.

Preparation

31. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
    a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
    b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
32. Existing Storm Widows: Remove existing storm windows and debris from site in accordance with Detailed Scope of Work.
33. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.
    a. Prime Window Jambs of Existing Prime Windows: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new storm windows.
    b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

34. General: Install in accordance with ASTM E 737, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
    a. Securely fasten storm windows in place to straight, plumb and level condition, without distortion of window or window frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
    b. Comply with applicable codes and regulations regarding egress requirements and fireman entry.
35. Joint Sealants: Apply in accordance with manufacturers recommendations.
    a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing calking and joint sealants from areas to receive new joint sealant.
    b. Prime cleaned surfaces in accordance with sealant manufacturers recommendations.
    c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
    d. Seal joints between perimeter of window frame and underlying or surrounding construction with joint sealant to accomplish weather-tight installation.
    e. Maximum Width of Sealed Joint: 13 mm (1/2 Inch).
36. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
    a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.
    b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Adjusting And Cleaning

37. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave storm windows and hardware in proper operating condition.
38. Cleaning: Comply with requirements of Detailed Scope of Work.

a. Clean storm windows after installation is completed to remove foreign matter and surface blemishes.
b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

39. Installed Work: Protect storm windows from damage after installation

END OF SECTION 08 51 69 00

Task	Specification	Specification Description
08 51 69 00	08 11 63 13a	Security Window Screens and Doors
08 51 69 00	08 51 13 00	Aluminum Windows
08 52 11 00	08 01 52 61	Wood Windows
08 52 16 00	08 01 52 61	Wood Windows
08 52 66 00	08 01 52 61	Wood Windows

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SECTION 08 53 13 00 - VINYL WINDOWS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for fixed and operable vinyl framed windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes fixed and operable vinyl-framed windows.

C. Definitions
1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
   a. AW: Architectural.
   b. HC: Heavy Commercial.
   c. C: Commercial.
   d. LC: Light Commercial.
   e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
   a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements
1. General: Provide vinyl windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:
   a. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance **OR** optional performance grade, **as directed**.
   b. Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide vinyl windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
   a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
      2) Importance Factor.
      3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

E. Submittals
1. Product Data: For each type of vinyl window indicated.

2. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details.
3. Samples: For each exposed finish.
4. Product Schedule: Use same designations indicated on Drawings.
5. Product test reports.
6. Maintenance data.
7. Warranty: Special warranty specified in this Section.

F. Quality Assurance
1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   a. Provide AAMA **OR** WDMA, **as directed**,-certified vinyl windows with an attached label.
3. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
4. Preinstallation Conference: Conduct conference at Project site.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Failure to meet performance requirements.
      2) Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
      3) Faulty operation of movable sash and hardware.
      4) Deterioration of vinyl, other materials, and finishes beyond normal weathering.
      5) Failure of insulating glass.
   b. Warranty Period:
      1) Window: Two **OR** Three **OR** 10, **as dirtected**, years from date of Final Completion.
      2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
      3) Vinyl Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Vinyl Extrusions: Rigid (unplasticized) hollow PVC extrusions, formulated and extruded for exterior applications, complying with AAMA/WDMA 101/I.S.2/NAFS and the following:
   a. PVC Resins: 100 percent virgin resin.
   b. PVC Formulation: High impact, low heat buildup, lead free, nonchalking, and color and UV stabilized.
   c. Extrusion Wall Thickness: Not less than 0.060 inch (1.5 mm) **OR** 0.090 inch (2.3 mm) **OR** 0.125 inch (3.2 mm), **as directed**.
   d. Multichamber Extrusions: Profile designed with two chambers **OR** three chambers **OR** multichambers, **as directed**, between interior and exterior faces of the extrusions.
2. Vinyl Trim and Glazing Stops: Material and finish to match frame members.
3. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with vinyl window members, cladding, trim, hardware, anchors, and other components.
   a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

4. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
5. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
6. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and for complete concealment when vinyl window is closed.
   a. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
   b. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
   c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
7. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
   a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
8. Replaceable Weather Seals: Comply with AAMA 701/702.

B. Window
1. Window Type: Casement **OR** Double hung **OR** Fixed **OR** Horizontal sliding **OR** Projected awning **OR** Single hung **OR** Bay **OR** Bow **OR** Specialty product **OR** As indicated on Drawings **OR** As indicated on a schedule, **as directed**.
2. AAMA/WDMA Performance Requirements: Provide vinyl windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
   a. Performance Class and Grade: R15 **OR** R20 **OR** R25, **as directed**.
   b. Performance Class and Grade: LC25 **OR** LC30 **OR** LC35, **as directed**.
   c. Performance Class and Grade: C30 **OR** C35 **OR** C40, **as directed**.
   d. Performance Class and Grade: HC40 **OR** HC45 **OR** HC50, **as directed**.
   e. Performance Class and Grade: AW40 **OR** AW45 **OR** AW50, **as directed**.
   f. Performance Class and Grade: As indicated.
   g. Performance Class (if test performance method is selected for specifying windows and designating a performance class does not conflict with basic wind speed and performance testing indicated): R **OR** LC **OR** C **OR** HC **OR** AW, **as directed**.
3. Condensation-Resistance Factor (CRF): Provide vinyl windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52 **OR** 65, **as directed**.
4. Thermal Transmittance: Provide vinyl windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed**.
   a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
5. Solar Heat-Gain Coefficient (SHGC): Provide vinyl windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
7. AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
   a. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa) which is equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes.

b. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind speed and is typically used to test HC and AW performance classes.

8. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
   a. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
   b. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
9. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
10. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
11. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

C. Glazing
1. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".
2. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed**.

D. Hardware
1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with vinyl; designed to smoothly operate, tightly close, and securely lock vinyl windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.
2. Counterbalancing Mechanism: Comply with AAMA 902.
   a. Sash-Balance Type: Concealed, tape-spring **OR** spiral-tube **OR** spring-loaded, block-and-tackle, **as directed**, type, of size and capacity to hold sash stationary at any open position.
3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks, **as directed**.
5. Roller Assemblies: Low-friction design.
6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
   a. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
   a. Locking mechanism and handles for manual operation.
   b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.

9. Limit Devices: Provide concealed friction adjustor, adjustable stay bar **OR** concealed support arms with adjustable, limited, hold-open, **as directed**, limit devices designed to restrict sash or ventilator opening.
   a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.

E. Insect Screens
1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.
   a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.
2. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
   a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
   b. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
   c. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
   d. Finish: Manufacturer's standard.
3. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration, in the following color. Comply with ASTM D 3656.
   a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
4. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
   a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
5. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.

F. Accessories
1. Dividers (False Muntins): Provide dividers in designs indicated for each sash lite, one per sash, removable from the exposed surface of interior lite of the sash **OR** two per sash, removable from the exposed surfaces of interior and exterior lites of the sash **OR** one permanently located between glazing lites in the airspace, **as directed**.
   a. Material: Extruded, rigid PVC **OR** Aluminum, **as directed**.
   b. Design: Rectangular **OR** Diamond, **as directed**.
   c. Color: White **OR** Beige, **as directed**.

G. Fabrication
1. Fabricate vinyl windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
   a. Welded Frame and Sash/Ventilator Corners: Miter-cut and fusion **OR** chemically, **as directed**, welded.
   b. Mechanically Fastened Frame and Sash/Ventilator Corners: Double-butt coped and fastened with concealed screws, **as directed**.

2. Fabricate vinyl windows that are reglazable without dismantling sash or ventilator framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
   a. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.
4. Mullions: Provide mullions and cover plates as shown, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units. Provide manufacturer's standard finish to match window units.
5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Provide manufacturer's standard finish to match window units. Provide subframes capable of withstanding design loads of window units.
6. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze vinyl windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
7. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
8. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant steel reinforcement complying with requirements for reinforcing members, or do both.
9. Bow **OR** Bay, **as directed**, Windows: Provide vinyl windows in configuration indicated. Provide window frames, fixed and operating sash, operating hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
   a. Angled mullion posts with interior and exterior trim.
   b. Angled interior and exterior extension and trim.
   c. Clear pine head and seat boards.
   d. Top and bottom plywood platforms.
   e. Exterior head and sill casings and trim.
   f. Support brackets.
10. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

H. Vinyl Finishes
1. Integral Finish and Color: Uniform, solid, homogeneous white **OR** beige, **as directed**, interior and exterior.
2. Organic Pigmented Finish: Manufacturer's standard finish, interior and exterior, complying with AAMA 613 **OR** AAMA 615, **as directed**, and paint manufacturer's written specifications for cleaning and painting.
   a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation
1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

B. Adjusting, Cleaning, And Protection
   1. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
   2. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
   4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
   5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 53 13 00

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Task	Specification	Specification Description
08 53 66 00	08 53 13 00	Vinyl Windows

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SECTION 08 56 19 00 - SECURITY WINDOWS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for security windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Vision security windows.
   b. Fixed, transaction security windows.
   c. Sliding, transaction security windows.

C. Performance Requirements
1. Ballistics-Resistance Performance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
   a. Listed and labeled as bullet resisting according to UL 752.
   b. Tested for ballistics resistance according to UL 752 **OR** ASTM F 1233 **OR** HPW-TP-0500.03 **OR** NIJ STD-0108.01, **as directed**, by a testing agency acceptable to authorities having jurisdiction.
   c. Certified as complying with SD-STD-01.01, by the U.S. State Department, for ballistics resistance when tested by a qualified testing agency.
2. Forced-Entry-Resistance Performance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
   a. Tested for forced-entry resistance according to HPW-TP-0500.03 **OR** ASTM F 1233, **as directed**, by a testing agency acceptable to authorities having jurisdiction.
   b. For Federal Government Work: Certified as complying with SD-STD-01.01, by the U.S. State Department, for forced-entry resistance when tested by a qualified testing agency.
3. Windborne-Debris-Impact-Resistance-Test Performance: Provide automatic entrances that pass large missile-impact and cyclic-pressure tests of ASTM E 1996 according to the IBC.
4. Structural Performance: Security windows shall withstand the effects of wind loads determined as follows, with no permanent deformation or breakage within window assembly when tested according to ASTM E 330:
   a. Basic Wind Speed: As indicated in miles per hour (meters per second) at 33 feet (10 m) above grade. Determine wind loads and resulting design pressures applicable to Project according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade as indicated on Drawings.
5. Air Infiltration for Operable Windows: Not more than 0.370 cfm/ft. (0.573 L/s per m) **OR** 0.500 cfm/ft. (0.774 L/s per m), **as directed**, of operable sash joint at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) when tested according to ASTM E 283.
6. Air Infiltration for Fixed Windows: Not more than 0.010 cfm/ft. (0.015 L/s per m) **OR** 0.060 cfm/ft. (0.093 L/s per m), **as directed**, of crack length at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) when tested according to ASTM E 283.
7. Water Penetration: No water penetration as defined in test method at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) **OR** 2.86 lbf/sq. ft. (137 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**, when tested according to ASTM E 331.

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings.

3. Samples: For each type of exposed finish required.
4. Welding certificates.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of security window and accessory indicated as ballistics **OR** forced-entry, **as directed**, resistant.
6. Configuration Disclosure Drawing: For each type of forced-entry-resistant security window, complying with ASTM F 1233.
7. Warranty: Sample of special warranty.

E. Quality Assurance
1. Testing Agency Qualifications: Qualified according to ASTM E 699 and experienced in ballistics- and forced-entry-resistance testing.
2. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   c. AWS D1.3, "Structural Welding Code - Sheet Steel."
   d. AWS D1.6, "Structural Welding Code - Stainless Steel."
3. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.
2. Label security window packaging with location in Project **OR** drawing designation, **as directed**.
3. Store crated security windows on raised blocks to prevent moisture damage.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace security windows that fail in materials or workmanship within three years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.125 inch (3.2 mm) thick at any location for main frame and sash members.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
4. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
5. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
6. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, austenitic stainless steel, Type 304 **OR** Type 316, **as directed**, stretcher-leveled standard of flatness.
7. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
8. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified testing agency.
   a. Threaded or wedge type; galvanized ferrous castings, either ASTM A 27/A 27M cast steel or ASTM A 47/A 47M malleable iron. Provide bolts, washers, and shims as required; hot-dip galvanized per ASTM A 153/A 153M or ASTM F 2329.

9. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.
10. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
11. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.76-mm) thickness per coat.
12. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

B. Window Components
1. Glazing: Comply with requirements in Division 08 Section "Security Glazing" for performance indicated.
   a. Comply with requirements of UL listing for ballistics-resistance level.
2. Compression-Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping, such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.
3. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers, and with a proven record of compatibility with surfaces contacted in installation.
   a. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
   b. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
   c. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   d. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
4. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressure indicated.

C. Vision Security Windows
1. Vision Security Windows: Provide fixed vision security windows with framing on four sides and no operable sash or ventilator.
2. Ballistics Resistance:
   a. Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8, **as directed**, when tested according to UL 752.
   b. HG1 **OR** HG2 **OR** HG3 **OR** HG4 **OR** SMG **OR** R1 **OR** R2 **OR** R3 **OR** R4-AP **OR** SH1 **OR** SH2, **as directed**, when tested according to ASTM F 1233.
   c. A **OR** B **OR** C **OR** D **OR** E, **as directed**, when tested according to HPW-TP-0500.03.
   d. S **OR** R **OR** AP **OR** SH, **as directed**, when tested according to SD-STD-01.01.
   e. Level I **OR** Level IIA **OR** Level II **OR** Level IIIA **OR** Level III **OR** Level IV, **as directed**, when tested according to NIJ STD-0108.01.
3. Forced-Entry Resistance:
   a. Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, when tested according to HPW-TP-0500.03.
   b. Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, when tested according to ASTM F 1233.
   c. Five **OR** 15 **OR** 60, **as directed**,-minute protection level when tested according to SD-STD-01.01.
4. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
   a. Material:
      1) Cold-rolled steel sheet, factory primed for field-painted finish **OR** with baked-enamel finish, **as directed**.

2) Galvanized-steel sheet, factory primed for field-painted finish.
3) Stainless-steel sheet with No. 4 finish.
4) Aluminum-clad steel sheet with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
5) Material: Extruded aluminum with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.

b. Profile: Manufacturer's standard **OR** Narrow, **as directed**, with minimum face dimension indicated.
c. Minimum Face Dimension: 2 inches (50 mm) **OR** 1-1/4 inches (32 mm) **OR** As indicated on Drawings, **as directed**.
d. Framing Depth:
1) Manufacturer's standard.
2) Adjustable for varying wall thicknesses by use of a two-piece, split frame that is attached to wall by clamping action induced by tightening screws.
3) As indicated on Drawings.
e. Framing Orientation: Vertical **OR** Incline subframe 5 degrees to vertical, with top of frame slanted away from protected side of window, **as directed**.

D. Fixed, Transaction Security Windows
1. Fixed, Transaction Security Windows: Provide fixed, framed transaction windows with operable sash or ventilator capable of allowing transfer of currency and documents.
2. Configuration: One fixed-glazed panel **OR** Multiple fixed-glazed panels **OR** As indicated on Drawings, **as directed**.
3. Ballistics Resistance:
a. Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8, **as directed**, when tested according to UL 752.
b. HG1 **OR** HG2 **OR** HG3 **OR** HG4 **OR** SMG **OR** R1 **OR** R2 **OR** R3 **OR** R4-AP **OR** SH1 **OR** SH2, **as directed**, when tested according to ASTM F 1233.
c. A **OR** B **OR** C **OR** D **OR** E, **as directed**, when tested according to HPW-TP-0500.03.
d. S **OR** R **OR** AP **OR** SH, **as directed**, when tested according to SD-STD-01.01.
e. Level I **OR** Level IIA **OR** Level II **OR** Level IIIA **OR** Level III **OR** Level IV, **as directed**, when tested according to NIJ STD-0108.01.
4. Forced-Entry Resistance:
a. Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, when tested according to HPW-TP-0500.03.
b. Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, when tested according to ASTM F 1233.
c. Five **OR** 15 **OR** 60, **as directed**,-minute protection level when tested according to SD-STD-01.01.
5. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
a. Material:
1) Cold-rolled steel sheet, factory primed for field-painted finish **OR** with baked-enamel finish, **as directed**.
2) Stainless-steel sheet with No. 4 finish.
3) Aluminum-clad steel sheet with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
4) Extruded aluminum with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
b. Profile: Manufacturer's standard **OR** Narrow, **as directed**, with minimum face dimension indicated.

c. Minimum Face Dimension: 2 inches (50 mm) **OR** 1-1/4 inches (32 mm) **OR** As indicated on Drawings, **as directed**.
d. Framing Depth:
1) Manufacturer's standard.
2) Adjustable for varying wall thicknesses by use of a two-piece, split frame that is attached to wall by clamping action induced by tightening screws.
3) As indicated on Drawings.
e. Provide thermally improved construction for aluminum framing.

6. Head and Jamb Framing: Designed for sealant glazing **OR** gasket glazing **OR** voice communication by speech at normal volume, **as directed**.
7. Channel-Frame Sill: Formed from stainless steel and designed for sealant glazing.
a. Transaction Counter: Stainless steel, 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, deep by width of security window, with integral deal tray centered in opening **OR** as indicated on Drawings, **as directed**.
b. Transaction Counter: Stainless steel, 21 inches (533 mm) deep by width of security window, with operable deal tray centered in opening **OR** as indicated on Drawings, **as directed**.
8. Voice-Communication-Type Sill: Formed from stainless steel and designed to allow passage of speech at normal speaking volume without distortion.
a. Sill Depth: 12 inches (305 mm) deep **OR** 18 inches (457 mm) deep with 6-inch (152-mm) deep projection on nonsecure side **OR** 21 inches (533 mm) deep with 6-inch (152-mm) deep projection on both sides, **as directed**.
b. Transaction Counter: Stainless steel, 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, deep by width of security window, with integral deal tray centered in opening **OR** as indicated on Drawings, **as directed**.
c. Integral Transaction-Drawer Sill: Formed from stainless steel **OR** framing to match head and jamb framing, **as directed**; with transaction drawer integrated into framing and contained in a stainless-steel housing that forms a transaction counter on secure side **OR** nonsecure side **OR** both sides, **as directed**, of opening. Drawer front shall be flush with housing when drawer is closed.

E. Sliding, Transaction Security Windows
1. Sliding, Transaction Security Windows: Provide horizontal-sliding, transaction security windows.
2. Configuration: One fixed-glazed panel and one horizontal-sliding glazed panel **OR** Two glazed panels that slide horizontally and meet at center of security window **OR** As indicated on Drawings, **as directed**.
3. Ballistics Resistance:
a. Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8, **as directed**, when tested according to UL 752.
b. HG1 **OR** HG2 **OR** HG3 **OR** HG4 **OR** SMG **OR** R1 **OR** R2 **OR** R3 **OR** R4-AP **OR** SH1 **OR** SH2, **as directed**, when tested according to ASTM F 1233.
c. A **OR** B **OR** C **OR** D **OR** E, **as directed**, when tested according to HPW-TP-0500.03.
d. S **OR** R **OR** AP **OR** SH, **as directed**, when tested according to SD-STD-01.01.
e. Level I **OR** Level IIA **OR** Level II **OR** Level IIIA **OR** Level III **OR** Level IV, **as directed**, when tested according to NIJ STD-0108.01.
4. Forced-Entry Resistance:
a. Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, when tested according to HPW-TP-0500.03.
b. Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, when tested according to ASTM F 1233.
c. Five **OR** 15 **OR** 60, **as directed**,-minute protection level when tested according to SD-STD-01.01.
5. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
a. Material:
1) Cold-rolled steel sheet, factory primed for field-painted finish **OR** with baked-enamel finish, **as directed**.

2) Material: Stainless-steel sheet with No. 4 finish.
3) Material: Aluminum-clad steel sheet with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
4) Material: Extruded aluminum with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.

b. Profile: Manufacturer's standard **OR** Narrow, **as directed**, with minimum face dimension indicated.
c. Minimum Face Dimension: 2 inches (50 mm) **OR** 1-1/4 inches (32 mm) **OR** As indicated on Drawings, **as directed**.
d. Framing Depth:
1) Manufacturer's standard.
2) Adjustable for varying wall thicknesses by use of a two-piece, split frame that is attached to wall by clamping action induced by tightening screws.
3) As indicated on Drawings.
e. Provide thermally improved construction for aluminum framing.

6. Head and Jamb Framing: Designed for sealant **OR** gasket, **as directed**, glazing.
7. Glazing Meeting Edges: Polished glazing.
8. Sill: Stainless-steel channel frame designed for sealant **OR** gasket, **as directed**, glazing.
a. Shelf: Stainless steel, 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, deep by width of security window, with integral deal tray.
9. Sliding Window Hardware: Provide roller track designed for overhead support of two- or four-wheel carriage supporting horizontal-sliding glazed panel. Provide manufacturer's standard pull and lock with two keys for each horizontal-sliding glazed panel.
a. Provide weather stripping for exterior horizontal-sliding, transaction security windows.

F. Accessories
1. Recessed Deal Trays: Formed from stainless steel with sliding stainless-steel cover, **as directed**; fabricated in curved shape with exposed flanges for recessed installation into horizontal surface.
a. Clear Opening Size: 12 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high) **OR** 12 inches wide by 11 inches deep by 1-1/2 inches high (305 mm wide by 279 mm deep by 38 mm high) **OR** 16 inches wide by 11 inches deep by 1-1/2 inches high (406 mm wide by 279 mm deep by 38 mm high), **as directed**.
2. Recessed, Nonricochet Deal Trays: Formed from stainless steel; fabricated with recessed bullet trap to ricochet bullets away from secure side, with exposed flanges for recessed installation into horizontal surface, and with sliding stainless-steel cover, **as directed**.
a. Clear Opening Size: 10 inches wide by 7 inches deep by 1-1/2 inches high (254 mm wide by 178 mm deep by 38 mm high) **OR** 12 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high) **OR** 12 inches wide by 11 inches deep by 1-1/2 inches high (305 mm wide by 279 mm deep by 38 mm high) **OR** 16 inches wide by 11 inches deep by 1-1/2 inches high (406 mm wide by 279 mm deep by 38 mm high), **as directed**.
b. Bullet Trap Location: Secure side **OR** Both sides, **as directed**.
c. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
d. Listed and labeled as bullet resisting according to UL 752.
3. Rotating Deal Trays: Formed from stainless steel, with rotating recessed deal tray on each side of secure opening and with handle that rotates deal trays 180 degrees.
a. Mounting: Drop in **OR** Countertop, **as directed**.
b. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
c. Listed and labeled as bullet resisting according to UL 752.

4. Transaction Drawers: Formed from stainless steel **OR** steel **OR** bullet-resistant armoring, **as directed**; with ball-bearing, telescoping sliding mechanism; with cover on secure side of top of drawer that automatically closes when drawer is extended to nonsecure side.
   a. Inside Dimensions: 15-3/8 inches wide by 8-1/2 inches deep by 4-3/8 inches high (390 mm wide by 216 mm deep by 111 mm high) **OR** 13 inches wide by 22 inches deep by 6-1/2 inches high (330 mm wide by 559 mm deep by 165 mm high), **as directed**.
   b. Operation:
      1) Manual.
      2) Electric, with sliding handle for emergency manual operation during lack of power. Provide individual switches for power and drawer movement on secure side and call button on nonsecure side.
   c. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
   d. Listed and labeled as bullet resisting according to UL 752.
5. Speaking Apertures: Fabricate from stainless steel **OR** security glazing, **as directed**, designed to allow passage of speech at normal speaking volume without distortion.
   a. Shape: Circular **OR** Square, **as directed**.
   b. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
   c. Listed and labeled as bullet resisting according to UL 752.

G. Fabrication
1. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
   a. Provide units that are reglazable from the secure side without dismantling the nonsecure side of framing.
   b. Prepare security windows for glazing unless preglazing at the factory is indicated.
2. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.
3. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
   a. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.
4. Glazing Stops: Finish glazing stops to match security window framing.
   a. Secure-Side (Exterior) Glazing Stops: Welded or integral to framing.
   b. Nonsecure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
5. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
6. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
7. Factory-cut openings in glazing for speaking apertures.
8. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Comply with requirements in Division 08 Section "Security Glazing".
9. Weather Stripping: Factory applied.

H. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
   a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

a. Color and Gloss: As selected from manufacturer's full range.

I. Metallic-Coated Steel Sheet Finishes
1. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780.
2. Factory Prime Finish: Apply an air-dried primer, complying with SSPC-Paint 5, immediately after cleaning and pretreating.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
a. Color and Gloss: As selected from manufacturer's full range.

J. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
c. Directional Satin Finish: No. 4.

1.3 EXECUTION

A. Installation
1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for concrete and masonry inserts, security fasteners, and other connectors.
a. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same forced-entry-resistance and ballistics-resistance performance as security window.
2. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than 6 inches (152 mm) from each corner and spaced not more than 12 inches (305 mm) o.c.
3. Glazed Framing: Provide sealant **OR** gasket, **as directed**,-glazed framing. Comply with installation requirements in Division 08 Section "Security Glazing".
4. Removable Glazing Stops and Trim: Fasten components with security fasteners.
5. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials, **as directed**.
6. Sealants: Comply with requirements in Division 07 Section "Joint Sealants" for installing sealants, fillers, and gaskets.
a. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
b. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.
7. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Adjusting

1. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.
2. Adjust transaction drawers to provide a tight fit at contact points and weather stripping for smooth operation and weathertight and secure enclosure.
3. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

C. Cleaning And Protection
1. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
   a. Lubricate sliding security window hardware.
   b. Lubricate transaction drawer hardware.
2. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Division 08 Section "Security Glazing" for cleaning and maintenance.
3. Provide temporary protection to ensure that security windows are without damage at time of Final Completion.

END OF SECTION 08 56 19 00

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Task	Specification	Specification Description
08 56 56 00	08 11 63 13a	Security Window Screens and Doors
08 56 56 00	08 34 53 00a	Security Grilles
08 56 59 00	01 22 16 00	No Specification Required

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SECTION 08 62 00 00 - ROOF WINDOWS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for roof windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Fixed (nonoperable) roof windows for exterior locations with aluminum-clad, copper-clad and fiberglass-clad exterior exposed surfaces and wood interior exposed surfaces.
b. Venting (with operable sash) roof windows for exterior locations with aluminum-clad, copper-clad and fiberglass-clad exterior exposed surfaces and wood interior exposed surfaces.

C. Performance Requirements
1. Structural Performance: Provide roof windows capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
a. Wind Loads: Compliance is based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural Test.
1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
2) Importance Factor.
3) Exposure Category: B **OR** C **OR** D, **as directed**.
b. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Deflection Test, or structural computations.
c. Snow Loads.
2. Windborne-Debris Resistance: Provide glazed roof windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed roof windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.

D. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
a. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
a. Mullion details, including reinforcement and stiffeners.
b. Joinery details.
c. Expansion provisions.
d. Flashing and drainage details.
e. Weather-stripping details.
f. Glazing details.
g. Accessories.
h. Window cleaning provisions.
i. Window System Operators: Show locations, mounting, and details for installing operator components and controls.

j. Window System Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
k. Wiring Diagrams: Power, signal, and control wiring.

3. Samples: For roof windows and components required, prepared on Samples of size indicated below.
   a. Main Framing Member: 12-inch- (300-mm-) long section with weather stripping, **as directed**, glazing bead and factory-applied color finish.
   b. Hardware: Full-size units with factory-applied finish.
4. Delegated-Design Submittal: For roof windows indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
   a. Structural test pressures and design pressures from loads indicated.
   b. Deflection limitations of glass framing systems.
5. Qualification Data: For qualified Installer, manufacturer and professional engineer.
6. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each class, grade, and size of roof window.
7. Maintenance Data: For weather stripping, operable sash, operating hardware, and finishes to include in maintenance manuals.
8. Warranties: Sample of special warranties.

E. Quality Assurance
1. Manufacturer Qualifications: A manufacturer capable of fabricating roof windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
2. Installer Qualifications: An installer acceptable to roof window manufacturer for installation of units required for this Project.
   a. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for roof windows, including Shop Drawings and Designated Design Submittal, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, "Standard/Specification for Windows, Doors, and Unit Skylights," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   a. Provide WDMA-certified units with an attached label.
4. Glazing Publication: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

F. Delivery, Storage, And Handling
1. Protect roof windows during transit, storage, and handling to prevent damage, soiling, and deterioration. Store off ground and covered in a clean, dry, well-ventilated, protected space. Comply with manufacturer's written instructions.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace roof windows that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Failure to meet performance requirements.
      2) Structural failures including excessive deflection.
      3) Water leakage or air infiltration.
      4) Faulty operation of movable panels and hardware.
      5) Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.

6) Deterioration of insulating glass and laminated glass, **as directed**, as defined in Division 08 Section "Glazing".

b. Warranty Period:
1) Roof Window: Five **OR** 10, **as directed**, years from date of Final Completion.
2) Glazing: 10 **OR** 20, **as directed**, years from date of Final Completion.
3) Exterior Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Wood: Clear fir or pine or another suitable fine-grained lumber; kiln-dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
a. Finish: Unfinished **OR** Manufacturer's standard transparent finish **OR** Manufacturer's standard prime-painted finish complying with WDMA T.M. 11 **OR** Manufacturer's standard opaque finish complying with WDMA T.M. 12, **as directed**.
2. Aluminum: Manufacturer's standard formed sheet or extruded aluminum. Provide aluminum alloy and temper recommended by roof window manufacturer for strength, corrosion resistance, and application of required finish.
a. Baked-Enamel Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1) Color and Gloss: White **OR** Bronze **OR** Brown **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
b. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 620 **OR** AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
3. Copper: ASTM B 370; Temper H00, cold rolled unless Temper 060, soft is required for forming; not less than 16 oz./sq. ft. (0.55 mm thick).
a. Finish: Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
4. Reinforced Thermoset Fiberglass: AAMA 305 with manufacturer's standard finish.
a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Trim and Glazing Stops: Material and finish to match wood frame members.
6. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive for SC 3 severe service conditions and compatible with roof window members, cladding, trim, hardware, anchors, and other components.
a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
7. Anchors, Clips, Mounting Brackets, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
8. Mullions: Provide mullions and mullion casing and cover plates as shown, matching roof window units, complete with anchors for support to structure and installation of roof window units. Allow for erection tolerances and provide for movement of roof window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of roof window units.

9. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
10. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when roof window is closed.
    a. Weather-Stripping Material: Closed-cell elastomeric, preformed gaskets complying with ASTM C 509.
       OR
       Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
       OR
       Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440.
11. Flashing: Manufacturer's standard flashing system for application indicated.
    a. Material: Aluminum **OR** Copper **OR** Flexible EPDM flashing, **as directed**.
    b. Rigid aluminum **OR** copper, **as directed**, nailing flange formed into frame.
    c. Auxiliary Water Diverter: Provide at roof window head as back flashing.

B. Roof Window
1. AAMA/WDMA/CSA Performance Requirements: Provide roof windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 unless more stringent performance requirements are indicated.
    a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
    b. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
    c. Performance Class and Grade: As indicated.
2. Thermal Transmittance: Provide roof windows with a whole fenestration product U-factor maximum indicated, when tested according to AAMA 1503 **OR** determined according to ASTM E 1423 **OR** determined according to NFRC 100, **as directed**.
    a. U-Factor: 0.35 **OR** 0.40 **OR** 0.65, **as directed**, Btu/sq. ft. x h x deg F (W/sq. m x K).
    b. U-Factor: 0.60 Btu/sq. ft. x h x deg F (W/sq. m x K) (this is the maximum U-factor allowed by the IECC 2006 for skylights in all but climate zones 1 to 3).
3. Solar Heat-Gain Coefficient (SHGC): Provide roof windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200.
4. Air-Leakage Resistance: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Air Leakage Resistance Test.
    a. Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 1.6 lbf/sq. ft. (75 Pa) (equivalent to 25-mph (40-km/h) wind speed and typically used to test R and C performance classes).
5. Water-Penetration Resistance: No water leakage as defined in AAMA/WDMA/CSA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Water Penetration Resistance Test.
    a. Test Pressure: 15 percent of positive design pressure, but not less than 2.9 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa).
6. Forced-Entry Resistance: Comply with Performance Grade 10 (lowest recognized by ASTM F 588 and is mandatory if AAMA/WDMA/CSA 101/I.S.2/A440 is the method selected for specifying roof window performance) requirements when tested according to ASTM F 588.
7. Operating Force and Auxiliary (Durability) Tests: According to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Glazing
1. Glass and Glazing System: Comply with Division 08 Section "Glazing" for glass, insulating-glass units, laminated glass, and glazing requirements applicable to glazed roof windows.

D. Hardware
1. Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for fixed skylights.

2. General: Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with wood and aluminum cladding **OR** and copper cladding, **as directed**, complying with AAMA 907; designed to smoothly operate, tightly close, and securely lock sliding wood-framed roof windows; and sized to accommodate sash weight and dimensions. Do not use aluminum in frictional contact with other metals.
   a. Hardware Finish: Manufacturer's standard **OR** Match cladding appearance, **as directed**.
3. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
4. Pole Operator: Manufacturer's standard manual **OR** motorized, **as directed**, pole for operating venting units that are more than 72 inches (1800 mm) above floor.
5. Motor Operator: Manufacturer's standard electric motor and remote control for operating venting units that are more than 72 inches (1800 mm) above floor.
   a. Provide rain sensor that automatically closes venting unit when water is detected.
      OR
      Provide motor operator with wireless remote-control device.
6. Roof Window Operation:
   a. Operator and Control: Gear-type rotary operator with plastic or metal cable that uncoils and stiffens to open sash; with locking mechanism.
      1) Operation: Crank handle **OR** Pole, **as directed**, for manual operation.
      2) Operation: Electric.
      OR
      Operator and Control: Gear-type rotary operator with arm(s) that scissors or swings to open sash; with locking mechanism.
      1) Operation: Crank handle **OR** Pole, **as directed**, for manual operation.
      2) Operation: Electric.
      OR
      Operator and Control: Spring-assisted, counter-balanced operator that allows sash to remain open in any position; with lever-handle-operated latches and lock for manual operation.
   b. Hinge: Continuous.
      OR
      Hinges: Pivot **OR** Manufacturer's standard, **as directed**; two per operable sash.

E. Accessories
1. Insect Screens: Manufacturer's standard removable screen; aluminum or vinyl frame with mitered or coped joints and with ASTM D 3656 mesh of plastic-coated glass-fiber threads. Provide frame in manufacturer's standard finish and mesh in manufacturer's standard color.
2. Shades: Manufacturer's standard of type indicated and in color and pattern selected from manufacturer's full range.
   a. Type: Pleated **OR** Venetian blind **OR** Roll up, **as directed**.
   b. Pole Operation: Provide manual **OR** motorized, **as directed**, pole for operating shades that are more than 72 inches (1800 mm) above floor.
      OR
      Motorized Operation: Provide manufacturer's standard electric motor and remote control for operating shades with wireless remote-control device, **as directed**.

F. Fabrication
1. Fabricate roof windows in sizes indicated. Include a complete system for assembling components and anchoring and flashing windows.
2. Fabricate roof windows that are reglazable without dismantling sash framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable sash.
4. Provide condensation gutter or other means to hold condensed moisture or drain it to exterior.
5. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

6. Factory-Glazed Fabrication: Glaze roof windows in the factory. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

1.3 EXECUTION

A. Examination
1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, slope of roof construction, and operational clearances. Examine roof decks, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight roof window installation.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. Comply with manufacturer's written installation instructions for installing roof windows, hardware, **as directed**, motor operators, **as directed**, accessories, and other components.
2. Install roof windows square, true, and without distortion, warp, or rack of frames and sash. Securely anchor windows to structural support without impeding thermal movement and in proper relation to adjacent construction.
3. Install flashing to provide a watertight and weathertight seal.
4. Separate aluminum, copper, and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to recommendations in ASTM E 2112.

C. Adjusting, Cleaning, And Protection
1. Lubricate hardware and moving parts.
2. Adjust operating sash, operators, **as directed**, screens, and accessories for a tight fit at contact points and for smooth operation and weathertight closure.
3. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
4. Adjust shades to hang true to line without rack. Provide unencumbered operation.
5. Clean frame surfaces immediately after installing roof windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
6. Inspect drainage holes for blockage. Clean and free holes of any obstructions to allow drainage.
7. Clean glass immediately after installing roof windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
8. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
9. Protect roof window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact roof window surfaces, remove contaminants immediately according to manufacturer's written instructions.
10. Refinish or replace roof windows that have damaged finishes.
11. Replace damaged components.

END OF SECTION 08 62 00 00

Task	Specification	Specification Description
08 62 23 00	08 62 00 00	Roof Windows
08 63 13 00	08 62 00 00	Roof Windows
08 66 00 00	08 45 23 00	Unit Skylights

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SECTION 08 71 11 00 - DETENTION DOOR HARDWARE

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for detention door hardware. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Detention door hardware for the following:
1) Swinging detention doors.
2) Sliding detention doors.
b. Detention cylinders for doors specified in other Sections.

C. Performance Requirements
1. Swinging Detention Door Assemblies: Provide detention door hardware as part of a detention door assembly that complies with security grade indicated, when tested according to ASTM F 1450, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
a. Bullet Resistance: Comply with Level 3 rating when tested according to UL 752; where indicated.
1) Listed and labeled as bullet resisting by a testing agency acceptable to authorities having jurisdiction.
b. Tool-Attack Resistance: Comply with small-tool-attack-resistance rating when tested according to UL 1034 and UL 437.
2. Detention Door Hardware Functional Performance: Provide detention door hardware with features, functions, and internal equipment required to perform control and monitoring functions indicated in Division 28 Section "Plc Electronic Detention Monitoring And Control Systems".

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: For each type of detention door hardware.
a. Wiring Diagrams: For power, signal, and control wiring; differentiate between manufacturer-installed and field-installed wiring for electrified and pneumatic, **as directed**, detention door hardware.
b. Compressed-Air System Diagrams: For compressed-air piping for door control systems; differentiate between manufacturer-installed and field-installed piping for pneumatic detention door hardware.
c. Detail interface between electrified detention door hardware and perimeter security, detention monitoring and control, fire-alarm, and building control, **as directed**, system.
d. Detail interface between pneumatic detention door hardware and perimeter security, detention monitoring and control, fire-alarm, and building control, **as directed**, system.
3. Other Action Submittals:
a. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with detention doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1) Integrate detention door hardware indicated in "Detention Door Hardware Sets" Article into the Door Hardware Schedule, and indicate complete designations of every item required for each door and opening.

b. Keying Schedule: Comply with requirements specified in Division 08 Section "Door Hardware". Coordinate detention keying with other door hardware in the final Keying Schedule.
   1) Indicate each lock and type of key using the following prefixes: "P" for paracentric, "M" for mogul, "HS" for high security, and "C" for commercial.
c. Operation and Maintenance Data: For electrified and pneumatic, **as applicable**, detention door hardware to include in emergency, operation, and maintenance manuals.

4. Warranties: Sample of special warranties.

E. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer and an authorized representative of detention door hardware manufacturer for installation and maintenance of units required for this Project.
2. Supplier Qualifications: Detention door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and the Owner about detention door hardware and keying.
   a. Detention Door Hardware Supplier Qualifications: An experienced detention door hardware supplier who has completed projects with electrified and pneumatic, **as directed**, detention door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
      1) Engineering Responsibility: Prepare data for electrified and pneumatic, **as directed**, detention door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
   b. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant **OR** one who meets the requirements necessary for certification, **as directed,** and who is experienced in providing consulting services for detention door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
   a. Detention Door Hardware Consultant Qualifications: Experienced in providing consulting services for electrified and pneumatic, **as directed**, detention door hardware installations.
4. Source Limitations for Detention Door Hardware: Obtain each type of detention door hardware from single source from single manufacturer.
   a. Provide electrified and pneumatic, **as directed**, detention door hardware from same manufacturer as mechanical detention door hardware unless otherwise indicated.
5. Regulatory Requirements: Comply with provisions of the following:
   a. Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1, **as directed**, as follows:
      1) Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      2) Security Door Closers: Comply with the following maximum opening-force requirements indicated:
         a) Interior Hinged Doors: 5 lbf (22 N) applied perpendicular to door.
         b) Sliding Doors: 5 lbf (22 N) applied parallel to door at latch.
         c) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   b. NFPA 101: Comply with the following for means-of-egress doors:
      1) Latches and Locks: Not more than 15 lbf (67 N) to release the latch.
      2) Security Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

3) Sliding Detention Door Devices: Not more than 50 lbf (222 N) to slide door to its fully open position with a perpendicular force of 50 lbf (222 N) against door.

c. Electrified and Pneumatic, **as directed**, Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Fire-Rated Detention Door Assemblies: Provide detention door hardware for assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** UBC Standard 7-2 **OR** UL 10B **OR** UL 10C, **as directed**.
7. Keying Conference: Conduct conference at Project site Incorporate keying conference decisions into the final Keying Schedule after reviewing detention door hardware keying system including, but not limited to, the following:
   a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   b. Preliminary key system schematic diagram.
   c. Requirements for key-control system including key exclusivity and duplication control.
   d. Address for delivery of keys.
8. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Inventory detention door hardware on receipt and provide secure lockup for detention door hardware delivered to Project site.
2. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
3. Deliver keys to the Owner by registered mail or overnight package service**.**

G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detention door hardware that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Structural failures including excessive deflection, cracking, or breakage.
      2) Faulty operation of operators and detention door hardware.
      3) Deterioration of metals, metal finishes, and other materials beyond normal weathering or detention use.
2. Warranty Period: Three years from date of Final Completion.
3. Warranty Period for Continuous-Pin Detention Hinges: 10 years from date of Final Completion.
4. Warranty Period for Security Door Closers: 10 years from date of Final Completion.

H. Maintenance Service
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of detention door hardware.
2. Initial Maintenance Service: Beginning at Final Completion, provide three **OR** six **OR** nine **OR** 12, **as directed**, months' full maintenance by skilled employees of detention door hardware Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper detention door hardware operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

1.2 PRODUCTS

A. Security Fasteners

1. General: Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:
   a. Drive-System Types: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
   b. Fastener Strength: 120,000 psi (827 MPa).
   c. Socket Button Head Fasteners:
      1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
      2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
   d. Socket Flat Countersunk Head Fasteners:
      1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
      2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
   e. Socket Head Cap Fasteners:
      1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
      2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
   f. Protective Coatings for Heat-Treated Alloy Steel:
      1) Zinc and clear trivalent chromium where indicated.
      2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

B. Detention Hinges, General
   1. Standard for Electric Detention Hinges: UL 634.
   2. Quantity: Provide the following unless otherwise indicated:
      a. Two Detention Hinges: For detention doors with heights up to 60 inches (1524 mm).
      b. Three Detention Hinges: For detention doors with heights 61 to 90 inches (1549 to 2286 mm).
      c. Four Detention Hinges: For detention doors with heights 91 to 120 inches (2311 to 3048 mm).
      d. For detention doors with heights more than 120 inches (3048 mm), provide four detention hinges, plus one detention hinge for every 30 inches (762 mm) of detention door height greater than 120 inches (3048 mm).
   3. Size: Provide the following, unless otherwise indicated, with detention hinge widths sized for 2-inch (51-mm) detention door thickness and clearances required:
      a. Doors up to 42 Inches (1067 mm) Wide: Minimum 4-1/2 inches (114 mm) wide by 0.180 inches (4.6 mm) thick or 5 inches (127 mm) wide by 0.190 inches (4.8 mm) thick.
      b. Doors Greater Than 42 Inches (1067 mm) Wide: Minimum 6 inches (152 mm) wide by 0.203 inches (5.2 mm) thick.
   4. Detention Doors with Security Closers: Unless otherwise indicated, provide antifriction-bearing detention hinges.
   5. Detention Hinge Base Metal: Unless otherwise indicated, provide the following:
      a. Exterior Detention Hinges: Stainless steel, with stainless-steel pin.
      b. Interior Detention Hinges: Steel, with steel pin **OR** Stainless steel, with stainless-steel pin, **as directed**.
      c. Detention Hinges for Fire-Rated Assemblies: Steel, with steel pin **OR** Stainless steel, with stainless-steel pin, **as directed**.
   6. Electrified Functions for Detention Hinges: Comply with the following:
      a. Electrical Contact: Exposed electrical contacts for transfer of power.
      b. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through detention hinge knuckle.
      c. Monitoring: Concealed electrical monitoring switch.
   7. Fastening: Comply with the following:
      a. Welding: Where indicated, weld hinges to detention doors and frames with continuous fillet weld around three sides of hinge perimeter.
      b. Security Fasteners: Provide socket flat countersunk head machine screws; finish screw heads to match surface of detention hinges. Install into drilled and tapped holes.

C. Detention Hinges
1. Utility-Door Detention Hinges DH-1: Heavy weight, plain bearing; fabricated from cast iron or steel; 3/8-inch- (9.5-mm-) diameter, case-hardened, fully welded, **as directed**, steel hinge pin; full surface.
   a. Leaves: Drilled for countersunk security fasteners **OR** Solid, **as directed**.
   b. Size: Minimum 3 by 4 inches by 0.200 inch (75 by 100 by 5 mm).
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, according to ASTM F 1758.
   d. Finish: BHMA 600.
2. Food-Pass Detention Hinges DH-2: Heavy weight, plain bearing; fabricated from cast iron or steel; 3/8-inch- (9.5-mm-) diameter, case-hardened, fully welded, **as directed**, steel hinge pin; with applied stop preventing door from opening more than 90 degrees and supporting door in horizontal position as a shelf; full surface.
   a. Leaves: Drilled for countersunk security fasteners **OR** Solid, **as directed**.
   b. Size: Minimum 3 by 4 inches by 0.200 inch (75 by 100 by 5 mm).
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, according to ASTM F 1758.
   d. Finish: BHMA 600.
3. Full-Surface Detention Hinges DH-3: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.
   a. Leaves: Drilled for countersunk security fasteners **OR** Solid, **as directed**.
   b. Size: Minimum 5 by 5-1/4 inches by 1/2 inch (127 by 133 by 13 mm).
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, according to ASTM F 1758.
   d. Finish: BHMA 600.
4. Half-Surface Detention Hinges DH-4: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.
   a. Leaves: Drilled for countersunk security fasteners **OR** Solid, **as directed**.
   b. Size: Minimum 5 by 5-1/4 inches by 1/2 inch (127 by 133 by 13 mm).
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, according to ASTM F 1758.
   d. Finish: BHMA 600.
5. Gap-Mounted Detention Hinges DH-5: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.
   a. Leaves: Drilled for countersunk security fasteners **OR** Solid, **as directed**.
   b. Size: Minimum 5 by 6 inches by 1/2 inch (127 by 152 by 13 mm).
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, according to ASTM F 1758.
   d. Finish: BHMA 600.
6. Continuous-Pin Detention Hinges DH-6: Minimum 0.109-inch- (2.78-mm-) thick, stainless-steel hinge leaves with minimum overall width of 4 inches (100 mm); with 1/4-inch- (6-mm-) diameter continuous pin; fabricated to full height of detention door and frame. Finish components after milling and drilling are complete. Fabricate continuous-pin detention hinges to template screw locations.
   a. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, according to ASTM F 1758.

D. Detention Locks And Latches, General
1. Swinging Detention Door Lock and Latch Performance: Provide detention door locks and latches that comply with security grade indicated, when tested according to ASTM F 1577, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
2. Detention Lock Functions: Provide function numbers and descriptions indicated in detention door hardware sets complying with ASTM F 1577.
3. Detention Lock Construction: Fabricate detention lock case and cover plate from steel plate. Fabricate bolts from solid sections; laminated construction unacceptable.
4. Detention Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
   a. Latchbolts for Detention Food Pass **OR** Security Access Doors, **as directed**: Minimum 5/8-inch (16-mm) latchbolt throw.

b. Latchbolts: Minimum 3/4-inch (19-mm) latchbolt throw.
c. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

5. Detention Lock Trim:
   a. Levers: Solid stainless steel.
   b. Knobs: Stainless steel **OR** Brass, **as directed**.
   c. Escutcheons for Paracentric Locks: 0.125-inch- (3.18-mm-) thick, 3-inch- (75-mm-) diameter stainless steel with BHMA 626 **OR** brass with BHMA 606, **as directed**, finish. Attach with security fasteners.
      1) Style: Single wing **OR** Double wing **OR** Single or double wing as required by lock function **OR** As indicated, **as directed**.
      2) Provide escutcheons unless otherwise **OR** where, **as directed**, indicated.
   d. Cylinder Shields for Paracentric Locks: 0.125-inch- (3.18-mm-) thick, 3-inch- (75-mm-) diameter stainless steel with BHMA 626 **OR** brass with BHMA 606, **as directed**, finish and swinging cover to protect keyhole. Attach with security fasteners.
      1) Style: Single wing **OR** Double wing **OR** Single or double wing as required by lock function **OR** As indicated, **as directed**.
      2) Provide cylinder shields unless otherwise **OR** where, **as directed**, indicated.
6. Pneumatic Detention Locks and Latches: Operate when supplied with air between 40 psig (275 kPa) minimum and 100 psig (690 kPa) maximum. Factory install quick-connect air fitting and factory-wired plug connector with 6-inch (150-mm) wire pigtail.
   a. Provide security ring for installation of pneumatic detention lock in hollow-metal detention frame, welded to frame or access cover unless otherwise **OR** where, **as directed**, indicated.

E. Mechanical Detention Locks And Latches
1. General: Provide mechanical detention lock mountings as follows:
   a. Hollow-Metal Detention Doors: Mount detention lock to back of 0.179-inch (4.56-mm) nominal-thickness steel **OR** 0.183-inch (4.65-mm) nominal-thickness galvanized-steel, **as directed**, cover plate for installation in lock pocket fabricated into detention door. Attach cover plate to hollow-metal detention door with security fasteners.
   b. Bar-Grille Detention Doors: Mount detention lock to back of galvanized, **as directed**, steel enclosure welded to flat horizontal bars of bar-grille detention door; cover with 0.179-inch (4.56-mm) nominal-thickness steel **OR** 0.183-inch (4.65-mm) nominal-thickness galvanized-steel, **as directed**, plate. Attach plate with security fasteners.
   c. Steel-Plate Detention Doors: Mount detention lock to inside surface of 0.179-inch (4.56-mm) nominal-thickness steel **OR** 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.183-inch (4.65-mm) nominal-thickness galvanized-steel **OR** 0.138-inch (3.50-mm) nominal-thickness galvanized-steel, **as directed**, enclosure with integrally formed mounting flanges. Attach enclosure to steel-plate detention door with security fasteners **OR** rivets, **as directed**.
2. Utility-Door Mechanical Deadlocks, Paracentric ML-1: For use on small swinging doors, such as access panels, plumbing space doors, electric panel doors, and hatches that are infrequently used.
   a. Function: Lockbolt retracted and extended by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
   b. Lockbolt: 1-1/2 inches high by 3/4 inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
3. Utility-Door Mechanical Deadlocks, Mogul ML-2: For use on small swinging doors, such as access panels, plumbing space doors, electric panel doors, and hatches that are infrequently used.
   a. Function: Lockbolt retracted and extended by mogul cylinder; keyed one side **OR** two sides, **as directed**.
   b. Lockbolt: 1-1/2 inches high by 3/4 inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.

c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

4. Mechanical Snaplatches, Paracentric ML-3: For use on small swinging doors, such as food-pass doors, observation panels, gun locker doors, and other small doors where snaplocking is needed and deadlocking is not required.
   a. Function: Automatic snaplatch when door is closed; latchbolt retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
   b. Latchbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 5/16-inch (8-mm) throw.
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
5. Mechanical Snaplatches, Mogul ML-4: For use on small swinging doors, such as food-pass doors, observation panels, gun locker doors, and other small doors where snaplocking is needed and deadlocking is not required
   a. Function: Automatic snaplatch when door is closed; latchbolt retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
   b. Latchbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 5/16-inch (8-mm) throw.
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
6. Mechanical Concealed Snaplatches ML-5: For use on small swinging doors, such as observation panels, wickets, covers, and other small doors.
   a. Function: Automatic snaplatch when door is closed; latchbolt retracted by five-tumbler paracentric cylinder; keyed one side. When closed, latch is concealed within lock case.
   b. Latchbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 7/16-inch (11-mm) throw.
   c. Provide angled strike.
   d. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
7. Sliding Door Mechanical Deadlatches ML-6: For use on sliding doors, such as entrance, safety vestibule, and corridor doors.
   a. Function: Hookbolt snaplatches and automatically deadlocks through action of plunger pin when door is closed (slam locking); hookbolt raised by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
   b. Hookbolt: 1/2-inch- (13-mm-) thick, case-hardened steel; 5/8-inch (16-mm) lift.
   c. Provide case-hardened-steel deadlock plunger pin.
   d. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
8. Sliding Door Mechanical Deadlocks ML-7: For use on sliding doors, such as entrance, safety vestibule, corridor, and inmate cell doors.
   a. Function: Hookbolt raised and lowered by five **OR** six, **as directed**,-tumbler paracentric cylinder (no slam locking); keyed one side **OR** two sides, **as directed**.
   b. Hookbolt: 1/2-inch- (13-mm-) thick, case-hardened steel; 5/8-inch (16-mm) lift.
   c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
9. Mechanical Snaplatches ML-8: For use on swinging doors, such as corridor, dining room, and recreational area doors.
   a. Function: Automatic snaplatch when door is closed (slam locking); latchbolt retracted by half turn and extended by full turn in opposite direction of five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
      1) Knob operation retracts latchbolt unless deadlocked. Locate knobs on one side **OR** two sides, **as directed**.
   b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw; 1/2-inch (13-mm) **OR** 1-1/4-inch (32-mm), **as directed**, bolt projection when retracted.
   c. Listed and labeled for use on fire doors.
   d. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
10. Mechanical Deadlatches/Deadlocks ML-9: For use on swinging doors, such as day room, dining room, and recreational area doors.
    a. Function: Automatic snaplatch and automatic deadlock through action of actuator when door is closed (slam locking); latchbolt retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
    b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw; 1/2-inch (13-mm) **OR** 1-1/4-inch (32-mm), **as directed**, bolt projection when retracted.

c. Deadlock Actuator: 3/4-inch-high by 3/4-inch- (19-mm-high by 19-mm-) thick steel; 1/2-inch (13-mm) throw.
d. Listed and labeled for use on fire doors.
e. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

11. Mechanical Deadlocks ML-10: For use on swinging doors where slam locking is not required, such as holding cell, segregation cell, control room, armory, key cabinet, storage, utility, and hollow-metal access doors.
    a. Function: Deadlocked in both locked and unlocked position; latchbolt retracted and extended by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
    b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw; 1/2-inch (13-mm) **OR** 1-1/4-inch (32-mm), **as directed**, bolt projection when retracted.
    c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
12. Cremone Bolt Mechanical Snaplatches ML-11: For use on swinging doors or active leaf of pairs of swinging doors where slam locking is needed.
    a. Function: Automatic snaplatch and deadlocking when door is closed (slam locking); latchbolt retracted and extended by five-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**. Lever operation one side **OR** two sides, **as directed**, retracts head and foot rods, unless deadlocked, for three-point locking.
    b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw.
    c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
13. Cremone Bolt Mechanical Deadlocks, Paracentric ML-12: For use on swinging doors or active leaf of pairs of swinging doors where doors may be subject to mass attack. Delete inactive leaf for single door.
    a. Function: Active leaf deadlocks when door is closed (no slam locking); active-leaf deadbolt retracted and extended by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**. Active-leaf lever operation one side **OR** two sides, **as directed**, retracts active-leaf head and foot bolts unless deadlocked.
        1) Inactive Leaf: Head and foot bolts deadlocked by five **OR** six, **as directed**,-tumbler, inactive-leaf paracentric cylinder. Inactive-leaf lever operation one side **OR** two sides, **as directed**, retracts inactive-leaf head and foot bolts unless deadlocked.
    b. Deadbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw.
    c. Head and Foot Bolts: 7/8-inch (22-mm) diameter; 3/4-inch (19-mm) throw.
    d. Provide foot bolt receptacle(s).
    e. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
14. Mechanical Head and Foot Bolts ML-14: For use on the inactive leaf of pairs of swinging doors.
    a. Function: Bolt retracted and extended by spanner-type key **OR** five-tumbler paracentric cylinder, **as directed**; enclosed in iron or steel case with steel cover (not applicable for hollow-metal doors).
    b. Latchbolt: 1-inch- (25-mm-) diameter steel; 3/4-inch (19-mm) throw.
    c. Footbolt Receptacle: Spring-loaded mechanism; brass.
    d. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

F. Electromechanical Detention Locks And Latches
1. General: Provide electromechanical detention locks and latches with factory-wired plug connector with 6-inch (152-mm) wire pigtail.
    a. Provide security ring for installation of electromechanical detention lock in hollow-metal detention frame, welded to frame or access cover, unless otherwise **OR** where, **as directed**, indicated.
    b. Equip direct-current solenoid-operated detention locks and latches with diode transient voltage protection at each locking device.

2. Solenoid-Operated Deadlatches, Paracentric EL-1: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric solenoid that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**; if latchbolt is retracted by key, it remains retracted until relocked by key.
      1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
      2) If power fails, latchbolt automatically deadlocks (fail secure).
   b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Provide roller-type deadlock actuator.
   e. Voltage: 120-V ac.
   f. Listed and labeled for use on fire doors.
   g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
3. Motor-Operated Deadlatches, Paracentric EL-2: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**; if latchbolt is retracted by key, it remains retracted until relocked by key.
      1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
      2) If power fails, latchbolt automatically deadlocks (fail-secure).
   b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Provide roller-type deadlock actuator.
   e. Voltage: 120-V ac **OR** 24-V dc, **as directed**.
   f. Listed and labeled for use on fire doors.
   g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
4. Sliding Door Motor-Operated Deadlatches EL-3: For use on sliding doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric motor that raises hookbolt; spring-loaded actuator pin pushes door open 1 to 3 inches (25 to 75 mm); automatic latching and deadlocking when door is closed (slam locking). Hookbolt can be mechanically raised by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**; if hookbolt is raised by key, it remains raised until relocked by key.
      1) Latchback: Hookbolt remains raised until door is opened 2 inches (50 mm), then lowers **OR** as long as control switch is in open position; hookbolt lowers when control switch is moved to locked position, **as directed**.
      2) If power fails, hookbolt automatically deadlocks (fail-secure).
   b. Hookbolt: 1-3/4- by 1/2-inch- (44- by 13-mm-) thick, case-hardened steel; 3/4-inch (19-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Provide case-hardened-steel deadlock actuator.
   e. Voltage: 120-V ac.
   f. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
5. Solenoid-Operated Deadlatches, Mogul EL-4: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.

a. Function: Remote switch activates electric solenoid that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
   1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
   2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
   3) Key Holdback: If latchbolt is retracted by key, it remains retracted until relocked by key (listing for use on fire doors is not available).
   4) Knob operation retracts latchbolt; always active.
   5) If power fails, latchbolt automatically deadlocks (fail-secure).
b. Latchbolt: 1-1/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; 1-inch (25-mm) throw.
c. Provide internal deadlock indicator switch.
d. Provide roller-type deadlock actuator.
e. Voltage: 120-V ac.
f. Listed and labeled for use on fire doors.
g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

6. Motor-Operated Deadlatches, Mogul EL-5: for use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
      1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is in open position; latchbolt extends when control switch is moved to locked position, **as directed**.
      2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
      3) Key Holdback: If latchbolt is retracted by key, it remains retracted until relocked by key (listing for use on fire doors is not available).
      4) Knob operation retracts latchbolt; always active.
      5) If power fails, latchbolt automatically deadlocks (fail-secure).
   b. Latchbolt: 1-1/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; 1-inch (25-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Provide roller-type deadlock actuator.
   e. Voltage: 120-V ac **OR** 24-V dc, **as directed**.
   f. Listed and labeled for use on fire doors.
   g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

7. Solenoid-Operated Deadlatches, Commercial EL-6: For use on swinging doors, hung in standard 2-inch (50-mm) hollow-metal frames, that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric solenoid that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by high-security, **as directed**, commercial cylinder; keyed one side **OR** two sides, **as directed**.
      1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
      2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
      3) If power fails, latchbolt automatically deadlocks (fail-secure).
   b. Latchbolt: 1-1/2-inch-high by 5/8-inch- (38-mm-high by 16-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
   c. Provide internal deadlock indicator switch.

d. Deadlock Actuator: Stainless steel.
e. Strike: Stainless steel.
f. Voltage: 24-V dc.
g. Listed and labeled for use on fire doors.
h. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

8. Motor-Operated Deadlatches, Commercial EL-7: For use on swinging doors, hung in standard 2-inch (50-mm) hollow-metal frames, that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by high-security, **as directed**, commercial cylinder; keyed one side **OR** two sides, **as directed**.
      1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is in open position; latchbolt extends when control switch is moved to locked position, **as directed**.
      2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
      3) If power fails, latchbolt automatically deadlocks (fail-secure).
   b. Latchbolt: 1-1/2-inch-high by 5/8-inch- (38-mm-high by 16-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Deadlock Actuator: Stainless steel.
   e. Strike: Stainless steel.
   f. Voltage: 24-V dc.
   g. Listed and labeled for use on fire doors.
   h. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
9. Solenoid-Operated Gate Locks, Paracentric EL-8: For use on swinging and sliding gates that are to be unlocked from remote locations.
   a. Function: Remote switch activates electric solenoid that raises an internal bolt; automatic deadlocking when gate is closed. Bolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
      1) Latchback: Bolt remains raised until gate is closed.
      2) If power fails, latchbolt automatically deadlocks (fail-secure).
   b. Bolt: 5/8-inch- (16-mm-) diameter stainless steel; 1-inch (25-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Voltage: 120-V ac.
   e. Finish: Galvanized.
   f. Mounting: Mount lock to gate post; mount locking tongue to gate frame.
   g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

G. Pneumatic Detention Locks And Latches
1. General: Provide pneumatic detention locks and latches that operate when supplied with air between 40 psig (275 kPa) minimum and 100 psig (690 kPa) maximum.
2. Factory install quick-connect air fitting and factory-wired plug connector with 6-inch (150-mm) wire pigtail.
   a. Provide security ring for installation of pneumatic detention lock in hollow-metal detention frame, welded to frame or access cover, unless otherwise **OR** where, **as directed**, indicated.
3. Pneumatic Deadlatches, Paracentric PL-1: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
   a. Function: Remote switch activates pneumatic cylinder that retracts latchbolt; latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated, **as directed**; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
      1) If power fails or compressed-air system fails, latchbolt automatically deadlocks (fail-secure).

b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
c. Provide internal deadlock indicator switch.
d. Provide roller-type deadlock actuator.
e. Voltage: 24-V dc.
f. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

4. Pneumatic Deadlatches, Mogul PL-2: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
   a. Function: Remote switch activates pneumatic cylinder that retracts latchbolt; latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated, **as directed**; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
      1) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
      2) Knob on opposite side of cylinder retracts latchbolt.
      3) If power fails or compressed-air system fails, latchbolt automatically deadlocks (fail-secure).
   b. Latchbolt: 1-1/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; 1-inch (25-mm) throw.
   c. Provide internal deadlock indicator switch.
   d. Provide roller-type deadlock actuator.
   e. Voltage: 24-V dc.
   f. Listed and labeled for use on fire doors.
   g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
5. Pneumatic Deadlatches, Commercial PL-3: For use on swinging doors, hung in standard 2-inch (50-mm) hollow-metal frames, that are to be unlocked from remote locations.
   a. Function: Remote switch activates pneumatic cylinder that retracts latchbolt; latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated, **as directed**; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by high-security, **as directed**, commercial cylinder; keyed one side **OR** two sides, **as directed**.
      1) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
      2) If power fails or compressed-air system fails, latchbolt automatically deadlocks (fail-secure).
   b. Latchbolt: 1-1/2-inch-high by 5/8-inch- (38-mm-high by 16-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
   c. Faceplate: Stainless steel.
   d. Provide internal deadlock indicator switch.
   e. Provide roller-type deadlock actuator.
   f. Voltage: 24-V dc.
   g. Listed and labeled for use on fire doors.
   h. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

H. Cylinders And Keying
1. General: Subject to compliance with requirements, provide cylinders and keying for paracentric and mogul cylinders by the same manufacturer as for detention locks and latches.
2. Commercial (Builders' Hardware) Cylinders: As specified in Division 08 Section "Door Hardware".
3. Paracentric Cylinders: Manufacturer's standard lever-tumbler type, constructed from one-piece spring-tempered brass; with tumblers activated by phosphor bronze springs; five tumblers per lock unless otherwise indicated.

4. Mogul Cylinders: Manufacturer's standard pin-tumbler type, minimum 2-inch (50-mm) diameter; body constructed from brass or bronze, stainless steel, or nickel silver; with stainless-steel tumblers and engaging cylinder balls; complying with the following:
   a. Number of Pins: Five **OR** Six **OR** Seven, **as directed**.
   b. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
      1) High-Security Grade: Listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A); where indicated.
   c. Finish: BHMA 606 **OR** BHMA 626, **as directed**.
5. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
   a. Paracentric cylinders operated by change keys only.
   b. No Master Key System: Mogul cylinders operated by change keys only.
      OR
      Master Key System: Mogul cylinders operated by a change key and a master key.
      OR
      Grand Master Key System: Mogul cylinders operated by a change key, a master key, and a grand master key.
      OR
      Great-Grand Master Key System: Mogul cylinders operated by a change key, a master key, a grand master key, and a great-grand master key.
   c. Existing System: Master key or grand master key mogul-cylinder locks to the Owner's existing system.
   d. Existing System: Re-key the Owner's existing master key system for mogul-cylinder locks into new keying system.
6. Keys: Provide cast silicon-bronze copper alloy keys complying with the following:
   a. Stamping: Permanently inscribe each key with a visual key-control number and include the following notation:
      1) Notation: "DO NOT DUPLICATE" **OR** Information to be furnished by the Owner, **as directed**.
   b. Quantity: In addition to one extra blank key for each lock, provide the following:
      1) Cylinder Change Keys: Three.
         OR
         Master Key(s): One.
         OR
         Grand Master Key(s): One.
         OR
         Great-Grand Master Key(s): One.

I. Switches
1. General: Provide switches configured with type of contacts required for functions indicated, including multiple circuiting where required by functional performance of Division 28 Section "Plc Electronic Detention Monitoring And Control Systems".
2. Concealed, Magnetic Door Position Switches: Consisting of actuating magnet mortised into detention door and switch mortised into frame; with stainless-steel faceplates; 24-V dc, factory wired with plug connector. Wire in series with lock monitors. Attach with security fasteners.
3. Concealed, Mechanical Door Position Switches: Consisting of metal track mortised into head of detention door connected by steel actuator arm to steel actuator mortised into frame; switch fully concealed when door is in closed position; with stainless-steel faceplate; 120-V ac; factory wired with plug connector. Action of door mechanically activates switch. Wire in series with lock monitors. Attach with security fasteners.
4. Surface-Mounted Door Position Switches: Switch enclosed in 0.134-inch (3.42-mm) nominal-thickness steel enclosure, factory primed for painting; 120-V ac; factory wired with plug connector. Wire in series with lock monitors. Attach with security fasteners.
   a. Galvanize enclosure for exterior locations and where indicated.

5. Strike Indicator Switches: Designed to be mortised behind strike and to indicate whether door is locked or unlocked; enclosed in metal strike box. Wire in series with door position switches. Attach with security fasteners.
   a. Voltage: 120-V dc **OR** 240-V ac **OR** As indicated, **as directed**.
   b. Locations: At doors with mechanical detention lock **OR** Where indicated, **as directed**.
   c. Manufacturer: Same as detention lock.
6. Inmate Door Control Switches, as directed: Momentary **OR** Maintained-contact, **as directed**, push-button switch with metal faceplate. Attach with security fasteners.
   a. Material and Finish: Brass with BHMA 606 **OR** Brass with BHMA 626 **OR** Stainless steel with BHMA 630, **as directed**, finish.
   b. Operation: When activated from remote location, switch allows inmate operation of electric cell door lock.
7. Push-Button, Inmate Door Control Switches, as directed: Momentary **OR** Maintained-contact, **as directed**, push-button switch for installation without faceplate. Attach with security fasteners.
   a. Material and Finish: Brass with BHMA 606 **OR** Brass with BHMA 626 **OR** Stainless steel with BHMA 630, **as directed**, finish.
   b. Operation: When activated from remote location, switch allows inmate operation of electric cell door lock.

J. Detention Operating Trim
1. Standard: BHMA A156.6, Grade 1.
2. Surface-Mounted Door Pulls (not typically used inside cells): 8-3/4-inch (222-mm) overall length and 2-1/4-inch (57-mm) projection; attach to door with two security fasteners.
   a. Material: Cast bronze with BHMA 606 **OR** BHMA 626, **as directed**, finish.
   b. Material: Cast stainless steel with BHMA 630 finish.
3. Round, Surface-Mounted Door Pulls (not typically used inside cells): 7-inch (178-mm) overall length by 1-inch- (25-mm-) diameter solid bar, with 2-1/4-inch (57-mm) projection; attach to door with two security through fasteners.
   a. Material: Cast or extruded bronze with BHMA 606 **OR** BHMA 626, **as directed**, finish.
   b. Material: Cast stainless steel with BHMA 630 finish.
4. Flush Door Pulls: 5 inches high by 4 inches wide by 1 inch deep (127 mm high by 102 mm wide by 25 mm deep), with 1/8-inch- (3-mm-) thick faceplate; attach to door with four security fasteners.
   a. Material: Formed, wrought, or cast brass/bronze with BHMA 606 **OR** BHMA 626, **as directed**, finish.
   b. Material: Formed or cast stainless steel with BHMA 630 finish.
5. Knob Pulls: 2-inch (50-mm) diameter; fabricated from solid brass with BHMA 606 **OR** BHMA 626, **as directed**, finish. Attach with security fasteners.
6. Lever-Handle Guides: Guide track and escutcheon, **as directed**, that provides selective stopping of lever handle by use of an adjustable stop; fabricated from steel with BHMA 633 **OR** stainless steel with BHMA 630, **as directed**, finish. Attach with security fasteners.

K. Security Door Closers
1. Standard: BHMA A156.4, Grade 1.
   a. Certified Products: Provide security door closers listed in BHMA's "Directory of Certified Products."
2. Surface-Mounted Security Door Closers:
   a. Arms: Minimum 3/8-inch- (9.5-mm-) thick by 1-1/8-inch- (29-mm-) wide, rectangular steel main arm; 5/16-inch- (8-mm-) thick by 1-inch- (25-mm-) wide, rectangular steel secondary arm; full rack-and-pinion type; fabricated with orbital-riveted, pinned, or welded elbow and arm shoe/soffit plate joints designed to prevent disassembly with ordinary hand tools.
   b. Cover: Heavy-duty metal, attached with four security fasteners.
   c. Mounting: Attach security door closer with security fasteners.
3. Concealed Security Door Closers:

a. Construction: Forged-steel arm; security roller; with track concealed in head of detention door, designed to eject foreign objects during opening and closing; fabricated with joints designed to prevent disassembly with ordinary hand tools. Closer arm and track fully concealed when door is closed.
b. Cover Plates: Heavy-duty metal, attached with security fasteners.
c. Provide door position switch integral to closer.

4. Unit Size: Unless otherwise indicated, comply with manufacturer's written recommendations for size of security door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

L. Detention Door Stops

1. Detention Floor Stops: 1-1/2-inch-high by 2-inch- (38-mm-high by 50-mm-) diameter rubber bumper mounted on steel lag bolt; BHMA A156.16; install in floor with nonshrink grout; for detention doors unless wall or other type stops are indicated. Do not mount floor stops where they will impede traffic.
2. Silencers for Detention Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 1/2-inch (13-mm) diameter; fabricated for drilled-in application to detention door frame. Attach with security fasteners.

M. Sliding Detention Door Device Assemblies

1. Performance Requirements: Provide sliding detention door device assemblies, including locking device, receiver, overhead door hanger, bottom door guide, lock column, and enclosure, as a complete assembly, complying with Grade 1 **OR** Grade 2, **as directed**, according to ASTM F 1643, as determined by testing manufacturers' standard units representing those indicated for Project.
2. Assembly Construction: As follows:
   a. Enclosure: Fabricated from 0.179-inch (4.56-mm) nominal-thickness steel plate, with 0.134-inch (3.42-mm) nominal-thickness steel removable **OR** hinged, **as directed**, cover. Baffle openings in enclosure. Provide closures for ends of housings.
      1) Provide sloping-top housings. Flat-top housings may be provided for operators mounted to ceiling, **as directed**.
   b. Lock Column: Vertical tube enclosure fabricated from 0.134-inch (3.42-mm) nominal-thickness steel, providing mechanical locking control of detention sliding door at door location; operated by paracentric key. Doors shall be capable of being locked at top and bottom, at rear of door, in both open and closed positions, with no components projecting into door opening.
   c. Receiver: Fabricated from 0.134-inch (3.42-mm) nominal-thickness steel plate.
   d. Hanger Assembly: Extend steel carrier full width of door and door travel required for clear door opening. Provide antifriction ball-bearing steel rollers with hardened members and grease shield.
   e. Finish: Factory prime painted.
3. Mechanical-Locking, Manual-Door-Movement, Sliding Door Device Assemblies SDA-1: Doors are manually opened and closed and mechanically locked by means of jamb-mounted mechanical detention lock specified elsewhere in this Section.
4. Electromechanical-Locking, Manual-Door-Movement, Sliding Door Device Assemblies SDA-2: Operated from remote-control panel that activates electric motors to unlock sliding doors. Doors spring open a small distance after unlocking and are manually opened and closed. Locks automatically deadlock when doors are moved to fully open or fully closed position. Provide factory-wired cable harness with plug connectors for each motor unit.
   a. Single-Door Function: In an emergency or if power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
   b. Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if power fails, door group can be manually operated from mechanical-release cabinet at end

of cell line **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.

c. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.

5. Electromechanical-Locking, Electromechanical-Door-Movement, Sliding Door Device Assemblies SDA-3: Operated from remote-control panel that activates electric motors to unlock sliding doors and motorized rack-and-pinion drive mechanisms to open and close doors. Doors lock in open position and deadlock when closed. Provide factory-wired cable harness with plug connectors for each motor unit.

   NOTE: Paragraph above describes Southern Folger's "Southern Steel Model 3150LX" and "Southern Steel Model 3165LX." Only the 3150LX system offers multiple door functions, such as for cell doors; the 3165LX system is for individual doors, such as for vestibules, day rooms, and corridors.

   1) Single-Door Function: In an emergency or if power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
   2) Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if power fails, door group can be manually operated from mechanical-release cabinet at end of cell line **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.

   b. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.

6. Electromechanical-Locking, Pneumatic-Door-Movement, Sliding Door Device Assemblies SDA-4 (for individual doors, such as for vestibules, day rooms, and corridors): Operated from remote-control panel that activates electric motors to unlock sliding doors and pneumatic system to open and close doors. Doors lock in open position and deadlock when closed. Factory install quick-connect air fitting and factory-wired cable harness with plug connectors for each motor unit; 24-V dc.

   a. Single-Door Function: In an emergency or if pneumatic systems or electric power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
      1) Lock Control at Door: Mechanical key release adjacent to receiving jamb of each door, contained in pilaster and operated by paracentric key; where indicated.

7. Pneumatic-Locking, Manual-Door-Movement, Sliding Door Device Assemblies SDA-5: Operated from remote-control panel that activates pneumatic cylinders to unlock doors. Doors spring open a small distance after unlocking and are manually opened and closed. Locks automatically deadlock when doors are moved to fully open or fully closed position. Factory install quick-connect air fitting and factory-wired cable harness with plug connectors for each motor unit.

   a. Single-Door Function: In an emergency or if pneumatic systems or electric power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
      1) Lock Control at Door: Mechanical key release adjacent to receiving jamb of each door, contained in pilaster and operated by paracentric key; where indicated.

   b. Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if pneumatic systems or electric power fails, door group can be operated from remotely located auxiliary pneumatic-release system **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.

   c. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.

8. Pneumatic-Locking, Pneumatic-Door-Movement, Sliding Door Device Assemblies SDA-6 (Paragraph below describes Southern Folger's "Southern Steel Model 8050L" and "Southern

Steel Model 8065L." Only the 8050L system offers multiple door functions, such as for cell doors; the 8065L system is for individual doors, such as for vestibules, day rooms, and corridors.): Operated from remote-control panel that activates pneumatic cylinder to unlock sliding doors and open and close doors. Doors lock in open position and deadlock when closed. Factory install quick-connect air fitting and factory-wired cable harness with plug connectors for each motor unit; 24-V dc.

a. Single-Door Function: In an emergency or if pneumatic systems or electric power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
b. Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if pneumatic systems or electric power fails, door group can be operated from remotely located auxiliary pneumatic-release system **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.
c. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.
d. Provide security ring for installation of pneumatic detention lock in hollow-metal detention frame, welded to frame or access cover, unless otherwise **OR** where, **as directed**, indicated.

N. Fabrication
1. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved.
2. Base Metals: Produce detention door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified detention door hardware units and BHMA A156.18 finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
3. Fasteners: Provide flat-head security fasteners with finished heads to match surface of detention door hardware unless otherwise indicated.
   a. Security Fasteners: Fabricate detention door hardware using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials. Provide stainless-steel security fasteners in stainless-steel materials, **as directed**.
   b. Concealed Fasteners: For detention door hardware units that are exposed when detention door is closed except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching detention door hardware. Where through bolts are used on hollow-metal detention door and frame construction, provide sleeves for each through bolt.
   c. Steel Machine Screws (for fire-rated detention door assemblies. NFPA 80 requires locks, latches, and surface-mounted top and bottom bolts to be secured with machine screws or through bolts.): For the following fire-rated applications:
      1) Mortise detention hinges to detention doors.
      2) Strike plates to detention frames.
      3) Security door closers to detention doors and frames.
   d. Steel Through Bolts (for fire-rated detention door assemblies. NFPA 80 requires locks, latches, and surface-mounted top and bottom bolts to be secured with machine screws or through bolts.): For the following fire-rated applications unless door blocking is provided:
      1) Surface detention hinges to detention doors.
      2) Security door closers to detention doors and frames.
   e. Spacers or Sex Bolts: For through bolting of hollow-metal detention doors.
   f. Fasteners for Wood Detention Doors: Comply with DHI WDHS.2.

O. Finishes
1. Standard: Comply with BHMA A156.18.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. BHMA Designations: Comply with base material and finish requirements indicated by the following:
a. BHMA 600: Primed for painting, over steel base metal.
b. BHMA 606: Satin brass, clear coated, over brass base metal.
c. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
d. BHMA 630: Stainless steel, satin, over stainless-steel base metal.
e. BHMA 652: Satin chromium plated over nickel, over steel base metal.

1.3 EXECUTION

A. Preparation
1. Steel Detention Doors and Frames: Comply with ANSI/DHI A115 Series.
a. Surface-Applied Detention Door Hardware: Drill and tap detention doors and frames according to ANSI/SDI A250.6.
2. Wood Detention Doors: Comply with DHI A115-W Series.

B. Installation
1. Mounting Heights: Mount detention door hardware units at heights indicated in the following applicable publications unless specifically indicated or required to comply with governing regulations:
a. Steel Detention Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
b. Wood Detention Doors: DHI WDHS.3.
2. Install each detention door hardware item to comply with Shop Drawings and manufacturer's written instructions. Where cutting and fitting are required to install detention door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09. Do not install surface-mounted items until finishes have been completed on substrates involved.
a. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
b. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
3. Install interconnecting wiring and connectors between detention door hardware devices. Terminate device wiring for detention door hardware installed in swinging doors at a plug-type connector located in lock pocket or door frame junction box and for sliding doors at a junction box in door frame.
4. Security Fasteners: Install detention door hardware using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials.

C. Field Quality Control
1. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
2. Perform the following field tests and inspections and prepare test reports:
a. After installing electrified and pneumatic, **as directed**, detention door hardware and after electrical circuitry has been energized and compressed-air system is functional, **as directed**, test detention door hardware for compliance with requirements.
1) Test: Operate lock of each door and group of doors in normal remote, normal local, and emergency operating modes. Verify that remote controls operate correct door locks and in correct sequence.

b. Verify that lock bolts engage strikes with required bolt projection.
c. Verify that detention door hardware is installed, connected, and adjusted according to the Contract Documents.
d. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements.

3. Remove and replace detention work if inspections indicate that work does not comply with specified requirements. Remove malfunctioning units, replace with new units, and retest as specified above.
4. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
5. Prepare field quality-control certification endorsed by Detention Specialist, **as directed**, that states installed products and their installation comply with requirements in the Contract Documents.

D. Adjusting
1. Adjust and check each operating item of detention door hardware and each detention door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust detention door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
a. Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
b. Security Door Closers: Adjust sweep period so that, from an open position of 90 degrees, detention door will take at least five seconds to move to a position of 12 degrees.

E. Cleaning And Protection
1. Clean adjacent surfaces soiled by detention door hardware installation.
2. Clean operating items as necessary to restore proper function and finish.
3. Provide final protection and maintain conditions that ensure that detention door hardware is without damage or deterioration at time of Final Completion.

1.4 Detention Door Hardware Sets

Note 1: Hanging devices below include detention hinges and sliding detention door device assemblies. Indicate whether detention hinges are attached to detention doors and frames by security fasteners or by welding.
Note 2: Securing devices (inactive leaf) below include door position switches and strike indicator switches.
Note 3: Securing devices (active leaf) below include detention locksets and latchsets, cylinders, door position switches, strike indicator switches, and inmate door control switches.\
Note 4: Operating trim below includes detention door pulls, flush pulls, knob pulls, and lever-handle guides.
Note 5: Closing devices below include security door closers.
Note 6: Stops below include detention floor stops and door silencers if not specified with steel detention doors and frames.
Note 7: Miscellaneous items that could be inserted at end of detention door hardware sets include key-control cabinets, software if not included in Division 08 Section "Door Hardware", and detention door hardware not otherwise listed.

A. General: Provide detention door hardware for each detention door to comply with requirements in this Section and detention door hardware sets indicated in a door and frame schedule **OR** and detention door hardware sets indicated below, **as directed**.

Detention Door Hardware Set No. [#]
Single Door No. [#]; each to have the following:

*	Hanging Devices	**<Insert description.>**	**<Insert manufacturer.>**	**<Insert finish.>**
[#]	Securing Devices	**<Insert description.>**	**<Insert manufacturer.>**	**<Insert finish.>**

	(inactive leaf)			
<#>	Securing Devices (active leaf)	**<Insert description.>**	**<Insert manufacturer.>**	**<Insert finish.>**
[#]	Operating Trim	**<Insert description.>**	**<Insert manufacturer.>**	**<Insert finish.>**
[#]	Closing Devices	**<Insert description.>**	**<Insert manufacturer.>**	**<Insert finish.>**
[#]	Stops	**<Insert description.>**	**<Insert manufacturer.>**	**<Insert finish.>**
*	Number of Hinges, as specified.			

Note 8: Insert additional requirements and sequence of operation in schedule above for electrified and pneumatic detention door hardware if required.

END OF SECTION 08 71 11 00

Task	Specification	Specification Description
08 71 11 00	01 22 16 00	No Specification Required
08 71 11 00	06 01 40 91	Door Hardware

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SECTION 08 71 13 00 - AUTOMATIC DOOR OPERATORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for automatic door operators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Power door operators for swinging doors.
b. Low-energy door operators for swinging doors.
c. Power-assist door operators for swinging doors.

C. Definitions
1. Double Egress Doors: A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
2. Double Swing Doors: A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single swing door.

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: For automatic door operators. Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each exposed product and for each color and texture specified.
4. Product certificates
5. Field quality-control reports.
6. Maintenance data.
7. Warranty: Sample of special warranty.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a certified inspector, **as directed**.
2. Certified Inspector Qualifications: Certified by the AAADM.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
4. Exit-Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.
5. Preinstallation Conference: Conduct conference at Project site.

F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:

a. Sheet: ASTM B 209 (ASTM B 209M).
b. Extrusions: ASTM B 221 (ASTM B 221M).

2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in manufacturer's standard thickness.
3. Brass Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in manufacturer's standard thickness.
4. Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in manufacturer's standard thickness.
5. Expanded Aluminum Mesh: Manufacturer's standard expanded **OR** expanded and flattened, **as directed**, aluminum sheet in accordance with the geometry of ASTM F 1267.
6. Polycarbonate: Manufacturer's standard monolithic polycarbonate sheet manufactured by extrusion process, with an average impact strength of 12 to 16 ft-lbf/in. (640 to 854 J/m) of width when tested according to ASTM D 256, Method A.
7. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

B. Automatic Door Operators, General

1. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
   a. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to automatic door operator when door is in emergency breakaway position, and to return to closed position after breakaway and automatically reset.
   b. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
   c. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of <**Insert wind load**>.
2. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
3. Electrohydraulic Operating System: Self-contained low-pressure unit; with separate cylinders for power and checking, connections for power and activation- and safety-device wiring, manual operation including spring closing when power is off.
4. Pneumatic Operating System: Pneumatic operator, air opened and spring closed, checking in both cycles, with doors manually operable when power is off.
   a. Power Unit: Manufacturer's standard remote compressor unit, complete with tank, compressor, motor, regulator, safety valve, pressure cutoff switch, and automatic air-line filter drain.

      OR

      Power Unit: As specified in Division 22 Section(s) "General-service Compressed-air Piping" AND "General-service Packaged Air Compressors And Receivers".
5. Hinges: See Division 08 Section "Door Hardware" for type of hinge for each door that door operator shall accommodate.
6. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch- (3.2-mm-) thick, extruded or formed aluminum and extending full width of door opening including door jambs to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
7. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- (3.2-mm-) thick extruded or formed aluminum; manufacturer's standard width; **OR** continuous over full width of operator-controlled door opening; **OR** continuous over full width of door opening including door jambs, **as**

directed; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

8. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
9. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.

C. Power Door Operators
1. Standard: BHMA A156.10.
2. Performance Requirements:
   a. Opening Force:
      1) Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails; not more than 15 lbf (67 N) required to open door to minimum required width.
      OR
      Power-Operated Swinging Doors: Not more than 30 lbf (133 N) required to manually open door if power fails.
      2) Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a door to open.
   b. Entrapment Protection: Not more than 40 lbf (178 N) required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf (133 N) required to prevent stopped door from moving in direction of closing.
3. Configuration: Operator to control single swinging door **OR** pair of swinging doors, **as directed**.
   a. Traffic Pattern: One way **OR** Two way **OR** Double swing **OR** Double egress, **as directed**.
   b. Operator Mounting: Surface **OR** Overhead concealed, **as directed**.
4. Operation: Power opening and power-assisted, **as directed**, spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.10.
5. Operating System: Electromechanical **OR** Electrohydraulic **OR** Pneumatic, **as directed**.
6. Microprocessor Control Unit: Solid-state controls.
7. Features:
   a. Adjustable opening **OR** closing **OR** opening and closing, **as directed**, speed.
   b. Adjustable opening **OR** closing, **as directed**, force.
   c. Adjustable backcheck.
   d. Adjustable hold-open time from zero to 30 seconds.
   e. Adjustable time delay.
   f. Adjustable acceleration.
   g. Adjustable limit switch.
   h. Obstruction recycle.
   i. On-off/hold-open switch to control electric power to operator; key operated, **as directed**.
8. Exposed Finish: Finish exposed components with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder coat **OR** metal cladding **OR** finish matching door and frame **OR** finish matching door hardware, **as directed**.
   a. Color: As selected from full range of industry colors and color densities.
   b. Metal Cladding: No. 4 directional-satin-finish stainless steel **OR** No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.

D. Low-Energy Door Operators
1. Standard: BHMA A156.19.
2. Performance Requirements:
   a. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release a latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.

b. Entrapment Protection: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.

3. Configuration: Operator to control single swinging door **OR** pair of swinging doors, **as directed**.
   a. Traffic Pattern: One way **OR** Two way **OR** Double swing **OR** Double egress, **as directed**.
   b. Operator Mounting: Surface **OR** Overhead concealed, **as directed**.
4. Operation: Power opening and power-assisted, **as directed**, spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
5. Operating System: Electromechanical **OR** Electrohydraulic **OR** Pneumatic, **as directed**.
6. Microprocessor Control Unit: Solid-state controls.
7. Features:
   a. Adjustable opening **OR** closing **OR** opening and closing, **as directed**, speed.
   b. Adjustable opening **OR** closing, **as directed**, force.
   c. Adjustable backcheck.
   d. Adjustable hold-open time from zero to 30 seconds.
   e. Adjustable time delay.
   f. Adjustable acceleration.
   g. Obstruction recycle.
   h. On-off/hold-open switch to control electric power to operator; key operated, **as directed**.
8. Exposed Finish: Finish exposed components with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder coat **OR** metal cladding **OR** finish matching door and frame **OR** finish matching door hardware, **as directed**.
   a. Color: As selected from full range of industry colors and color densities.
   b. Metal Cladding: No. 4 directional-satin-finish stainless steel **OR** No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.

E. Power-Assist Door Operators
1. Standard: BHMA A156.19.
2. Performance Requirements:
   a. Opening Force:
      1) If Power Fails: Not more than 15 lbf (67 N) required to release a latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
      2) Accessible Interior Doors: Not more than 5 lbf (22 N) to fully open door.
   b. Entrapment Protection: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.
3. Configuration: Operator to control single swinging door **OR** pair of swinging doors, **as directed**.
   a. Traffic Pattern: One way **OR** Two way **OR** Double swing **OR** Double egress, **as directed**.
   b. Operator Mounting: Surface **OR** Overhead concealed, **as directed**.
4. Operation: Power-assisted opening that reduces force to open door and power-assisted, **as directed**, spring closing. Pushing or pulling on door activates the operator. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
5. Operating System: Electromechanical **OR** Electrohydraulic **OR** Pneumatic, **as directed**.
6. Microprocessor Control Unit: Solid-state controls.
7. Features:
   a. Adjustable opening **OR** closing **OR** opening and closing, **as directed**, speed.
   b. Adjustable opening **OR** closing, **as directed**, force.
   c. Adjustable backcheck.
   d. Adjustable latch speed.
   e. Adjustable hold-open time from zero to 30 seconds.

f. Adjustable time delay.
g. Adjustable acceleration.
h. Obstruction recycle.
i. On-off/hold-open switch to control electric power to operator; key operated, **as directed**.

8. Exposed Finish: Finish exposed components with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder coat **OR** metal cladding **OR** finish matching door and frame **OR** finish matching door hardware, **as directed**.
   a. Color: As selected from full range of industry colors and color densities.
   b. Metal Cladding: No. 4 directional-satin-finish stainless steel **OR** No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.

F. Activation And Safety Devices
1. General: Provide activation and safety devices in accordance with BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
2. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10.
   a. Provide capability for switching between bidirectional and unidirectional detection.
   b. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
3. Presence Sensors: Self-contained, infrared-scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
4. Combination Motion/Presence Sensors: Self-contained units consisting of both motion and presence sensors in a single housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
   a. Motion Sensor: K-band-frequency, microwave-scanner units.
      1) Provide capability for switching between bidirectional and unidirectional detection.
      2) For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
   b. Presence Sensor: Infrared-scanner units that remain active at all times.
5. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
6. Control Mats: 1/2-inch- (13-mm-) thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and complying with performance requirements in BHMA A156.10.
   a. Frame: Recessed to fit flush with floor, with concealed anchors **OR** Surface mounted, with tapered safety edge, **as directed**.
   b. Size: As indicated, but not smaller than required by BHMA A156.10 including Appendix A.
   c. Color: As selected from full range of industry colors and color densities.
7. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message, **as directed**.
   a. Configuration: Round **OR** Square, **as directed**, push plate with 4-by-4-inch (100-by-100-mm) junction box.
      1) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** As indicated on Drawings, **as directed**.
   b. Configuration: Rectangular push plate with 2-by-4-inch (50-by-100-mm) junction box.
      1) Mounting: Recess mounted, semiflush in wall **OR** Recess mounted in door jamb **OR** Surface mounted on wall **OR** Surface mounted on post **OR** Surface mounted on guide rail **OR** As indicated on Drawings, **as directed**.
   c. Push-Plate Material: Stainless steel **OR** Plastic, **as directed**, as selected from manufacturer's full range.
   d. Message: Plain face with no message **OR** "Push to Open" **OR** International symbol of accessibility **OR** International symbol of accessibility and "Push to Open", **as directed**.

8. Push-Button Switch: Momentary-contact door control switch with one red-button actuator; enclosed in nominal 2-by-4-inch (50-by-100-mm) **OR** 4-by-4-inch (100-by-100-mm), **as directed**, junction box.
   a. Provide faceplate engraved with "Press to Open" text and international symbol of accessibility, **as directed**, in contrasting color.
   b. Provide blue plastic cover engraved with "Press Button to Open" in white text and international symbol of accessibility.
   c. Mounting: Surface mounted on wall **OR** Surface mounted on post **OR** Surface mounted on guide rail **OR** Recess mounted in wall **OR** As indicated on Drawings, **as directed**.
   d. Faceplate Material: Stainless steel **OR** Painted metal, **as directed**, as selected from manufacturer's full range.
9. Key Switch: Recess-mounted, door control switch with key-controlled actuator; enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with text indicating switch functions.
   a. Faceplate Material: Stainless steel **OR** Painted metal, **as directed**, as selected from manufacturer's full range.
   b. Functions: On-off, momentary contact **OR** On-off, maintained contact **OR** Two-way automatic, hold open, one-way exit, and off **OR** Two-way automatic, hold open, one-way exit, off, full open, and partial open, **as directed**.
   c. Mounting: Recess mounted, semiflush in wall **OR** Recess mounted in door jamb **OR** Surface mounted on wall **OR** Surface mounted on post **OR** As indicated on Drawings, **as directed**.
10. Wireless or Remote Radio-Control Switch: Manufacturer's standard radio-control system consisting of header-mounted receiver and wall-mounted **OR** hand-held, battery-operated, **as directed**, transmitter switch.
    a. Wall-Mounted Transmitter Switch: One red-button, momentary-contact actuator enclosed in 4-by-4-inch (100-by-100-mm) junction box. Provide blue plastic cover engraved with "Press Button to Open" in white text and international symbol of accessibility.
11. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

G. Fabrication
1. Factory fabricate automatic door operators to comply with indicated standards.
2. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.
3. Form aluminum shapes before finishing.
4. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
5. Provide metal cladding, completely cladding visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

H. Accessories
1. Signage: As required by cited BHMA standard for the type of operator.
   a. Application Process: Decals **OR** Silk-screened **OR** Door manufacturer's standard process, **as directed**.
   b. Provide sign materials with instructions for field application when operators are installed.
2. Guide Rails: Anodized aluminum **OR** Baked-enamel or powder-coated aluminum **OR** Stainless steel, **as directed**, fabricated from bars **OR** tubing, **as directed**, minimum 30 inches (762 mm) high, and finished to match doors unless otherwise indicated; positioned and projecting from face of door jamb for distance as indicated, but not less than that required by BHMA A156.10 for type of door and direction of travel; with filler panel.
   a. Filler Panel: Expanded aluminum mesh **OR** Polycarbonate plastic, **as directed**.

1) Orient expanded aluminum mesh with long dimension of diamonds parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical, **as directed**.
2) Color: As selected from manufacturer's full range.

b. Provide intermediate guide rail suitable for supporting photoelectric beams.
c. Mounting: Jamb and floor **OR** Floor, freestanding, **as directed**.

OR

Guide Rails: See Division 05 Section(s) "Metal Fabrications" OR "Pipe And Tube Railings" OR "Decorative Metal", **as directed**.

I. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
4. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

1.3 EXECUTION

A. Installation
1. General: Install complete automatic door operators according to manufacturer's written instructions, including activation and safety devices, control wiring, and remote power units if any; connection to the building's power supply; and signage.
a. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
b. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
c. Power Door Operator Installation Standard: BHMA A156.10.
d. Low-Energy Door Operator Installation Standard: BHMA A156.19.
2. Power Connection: See Division 26 for connection to electrical power distribution system and see Division 22 for connection to compressed-air distribution piping, **as directed**.
3. Activation and Safety Devices: Install devices and wiring according to manufacturer's written instructions and cited BHMA standard for type of operator and direction of pedestrian travel. Connect activation- and safety-device wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
4. Access-Control System: Connect operators to access-control system as specified in Division 28 Section "Access Control".
5. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.
6. Guide Rails: Install according to BHMA A156.10 including Appendix A and manufacturer's written instructions unless otherwise indicated.

B. Field Quality Control
1. Inspection: Engage Installer's certified inspector to test and inspect automatic door operators and prepare test and inspection reports.

a. Certified inspector shall test and inspect each automatic door operator to determine compliance of installed systems with applicable BHMA standards.
b. Inspection Report: Certified inspector shall submit report in writing to the Owner and Contractor within 24 hours after inspection.

2. Work will be considered defective if it does not pass tests and inspections.

C. Adjusting

1. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
   a. Adjust operators on exterior doors for weathertight closure.
2. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
3. Readjust automatic door operators after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
4. Occupancy Adjustment: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 08 71 13 00

Task	Specification	Specification Description
08 72 33 00	06 48 13 00	Wood Doors
08 72 33 00	08 05 13 00a	Flush Wood Doors
08 72 33 00	06 01 40 91	Door Hardware
08 72 43 00	06 01 40 91	Door Hardware
08 75 13 00	06 01 40 91	Door Hardware
08 75 13 00	08 71 13 00	Automatic Door Operators
08 78 00 00	08 71 11 00	Detention Door Hardware
08 81 23 13	07 42 13 19	Glazing
08 81 23 23	07 42 13 19	Glazing

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SECTION 08 83 13 00 - MIRRORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for mirrors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes the following types of silvered flat glass mirrors:
   a. Annealed monolithic glass mirrors.
   b. Film-backed, Laminated and Tempered glass mirrors qualifying as safety glazing.

C. Submittals
1. Product Data: For each type of product indicated.
   a. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
2. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
3. Samples: For each type of the following products:
   a. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
   b. Mirror Clips: Full size.
   c. Mirror Trim: 12 inches (300 mm) long.
4. Qualification Data: For qualified Installer.
5. Product Certificates: For each type of mirror and mirror mastic, from manufacturer.
6. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing paint **OR** film, **as directed**, and substrates on which mirrors are installed.
7. Maintenance Data: For mirrors to include in maintenance manuals.
8. Warranty: Sample of special warranty.

D. Quality Assurance
1. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
2. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
3. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
4. Glazing Publications: Comply with the following published recommendations:
   a. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
   b. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
5. Safety Glazing Products: For film-backed, laminated and tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
6. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing paint **OR** film, **as directed**, and substrates on which mirrors are installed.

E. Delivery, Storage, And Handling

1. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
2. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

F. Project Conditions
1. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

G. Warranty
1. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Silvered Flat Glass Mirrors
1. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process, **as directed**.
2. Clear Glass: Mirror Select **OR** Glazing, **as directed**, Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission, **as directed**.
a. Nominal Thickness: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
3. Tinted Glass: Mirror Glazing Quality.
a. Nominal Thickness: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
b. Tint Color: Blue **OR** Black **OR** Bronze **OR** Gold **OR** Gray **OR** Green **OR** Peach **OR** Pink, **as directed**.
4. Tempered Clear **OR** Tinted, **as directed**, Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
a. Nominal Thickness: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
b. Tint Color: Blue **OR** Black **OR** Bronze **OR** Gold **OR** Gray **OR** Green **OR** Peach **OR** Pink, **as directed**.
5. Laminated Mirrors: ASTM C 1172, Kind LM.
a. Clear Glass for Outer Lite: Mirror Select **OR** Glazing, **as directed**, Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission, **as directed**.
b. Tinted Glass for Outer Lite: Mirror Glazing Quality.
1) Tint Color: Blue **OR** Black **OR** Bronze **OR** Gold **OR** Gray **OR** Green **OR** Peach **OR** Pink, **as directed**.
c. Nominal Thickness for Outer Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
d. Glass for Inner Lite: Annealed float glass; ASTM C 1036, Type I (transparent flat glass), Quality-Q3; Class 1 (clear).
OR
Glass for Inner Lite: Heat-treated float glass; ASTM C 1048 Type I; Quality-Q3; Class I (clear) Kind HS, Condition A.
OR

Glass for Inner Lite: Tempered float glass; ASTM C 1048 Type I; Quality-Q3; Class I (clear), Kind FT, Condition A.

e. Nominal Thickness for Inner Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.

f. Interlayer: Mirror manufacturer's standard 0.030-inch- (0.76-mm-) thick, clear polyvinyl-butyral interlayer with a proven record of showing no tendency to delaminate from, or cause damage to, silver coating.

B. Miscellaneous Materials

1. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
2. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
3. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
4. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

C. Mirror Hardware

1. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
   a. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm) **OR** 0.05 inch (1.3 mm), **as directed**.
   b. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
   c. Finish: Clear **OR** Gold, **as directed**, bright anodized.
2. Top Channel/Cleat and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
   a. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch (7.9 and 19 mm) in height, respectively.
   b. Top Trim: Formed with front leg with a height of 5/16 inch (7.9 mm) and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
   c. Finish: Clear **OR** Gold, **as directed**, bright anodized.
3. Mirror Bottom Clips: As indicated.
4. Mirror Top Clips: As indicated.
5. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
   a. Profile: As indicated.
   b. Finish: Selected from manufacturer's standards.
6. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
7. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

D. Fabrication

1. Mirror Sizes: To suit Project conditions, and before tempering, **as directed**, cut mirrors to final sizes and shapes.
2. Cutouts: Fabricate cutouts before tempering, **as directed**, for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

3. Mirror Edge Treatment: Flat polished **OR** Rounded polished **OR** Flat high-polished **OR** Rounded high-polished **OR** Beveled polished edge of width shown, **as directed**.
   a. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
   b. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
4. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

1.3 EXECUTION

A. Examination
1. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
2. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

B. Preparation
1. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

C. Installation
1. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
2. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
3. Wall-Mounted Mirrors: Install mirrors with mirror hardware **OR** mastic and mirror hardware, **as directed**. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   a. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
   b. Top Channel/Cleat and Bottom Aluminum J-Channels: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
   c. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips where indicated **OR** so they are symmetrically placed and evenly spaced, **as directed**.
   d. Install mastic as follows:
      1) Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
      2) Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
      3) After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

D. Cleaning And Protection

1. Protect mirrors from breakage and contaminating substances resulting from construction operations.
2. Do not permit edges of mirrors to be exposed to standing water.
3. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
4. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Final Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 83 13 00

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Task	Specification	Specification Description
08 83 13 00	07 42 13 19	Glazing

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SECTION 08 84 00 00 - PLASTIC GLAZING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for plastic glazing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Monolithic acrylic glazing.
b. Monolithic polycarbonate glazing.
c. Multiwalled structured polycarbonate glazing.

C. Performance Requirements
1. Provide plastic glazing sheets and glazing materials capable of withstanding normal temperature changes, wind, and impact loads without failure, including loss or breakage of plastic sheets attributable to the following: failure of sealants or gaskets to remain watertight and airtight, deterioration of plastic sheet and glazing materials, or other defects in materials and installation.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on plastic glazing and glazing framing members.
a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Preconstruction Testing
1. Preconstruction Adhesion and Compatibility Testing: Test each plastic glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
a. Testing will not be required if data are submitted based on previous testing of current sealant products and plastic glazing matching those submitted.
b. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glazing, tape sealants, gaskets, and glazing channel substrates.
c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
e. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Data for Credit EQ 4.1: For glazing sealants used inside the weatherproofing system, including printed statement of VOC content.
3. Plastic Glazing Samples: For each color and finish of plastic glazing indicated, 12 inches (300 mm) square and of same thickness indicated for final Work.
4. Glazing Accessory Samples: For gaskets and sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, **as directed**.
5. Plastic Glazing Schedule: List plastic glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of

plastic glazing and construction that receives plastic glazing, including clearances and glazing channel dimensions.

6. Qualification Data: For installers, plastic glazing testing agency and sealant testing agency.
7. Product Certificates: For plastic glazing and glazing products, from manufacturer.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for plastic glazing, glazing sealants and glazing gaskets.
   a. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
9. Preconstruction adhesion and compatibility test report.
10. Research/Evaluation Reports: For plastic glazing.
11. Maintenance Data: For plastic glazing to include in maintenance manuals.
12. Warranty: Sample of special warranty.

F. Quality Assurance
1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Source Limitations: Obtain plastic glazing from single source from single manufacturer. Obtain sealants and gaskets from single source from single manufacturer for each product and installation method.
3. Glazing Publication: Comply with published recommendations of plastic glazing manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glazing terms not otherwise defined in this Section or in other referenced standards.
4. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.
5. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of a certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of plastic glazing, thickness, and safety glazing standard with which glass complies.

G. Delivery, Storage, And Handling
1. Protect plastic glazing materials according to manufacturer's written instructions. Prevent damage to plastic glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
2. Maintain protective coverings on plastic glazing to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

H. Project Conditions
1. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

I. Coordination
1. Coordinate dimensions of plastic glazing with dimensions of construction that receives plastic glazing to ensure that glazing channels provide adequate face and edge clearance, bite, and allowance for expansion.

J. Warranty
1. Manufacturer's Special Warranty for Abrasion- and UV-Resistant, Monolithic **OR** Multiwalled Structured, **as directed**, Polycarbonate: Manufacturer's standard form, made out to the Owner and signed by polycarbonate manufacturer, in which manufacturer agrees to replace polycarbonate products that break or develop defects from normal use that are attributable to manufacturing process and not to practices for maintaining and cleaning plastic glazing contrary

to manufacturer's written instructions. Defects include coating delamination, haze, excessive yellowing, and loss of light transmission beyond the limits stated in plastic glazing manufacturer's standard form.

a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Plastic Glazing, General

1. Sizes: Fabricate plastic glazing to sizes required for openings indicated. Allow for thermal expansion and contraction of plastic glazing without restraint and without withdrawal of edges from frames, with edge clearances and tolerances complying with plastic glazing manufacturer's written instructions.
2. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.
   a. Self-ignition temperature of 650 deg F (343 deg C) or higher when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
   b. Smoke-developed index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
   c. Burning extent of 1 inch (25 mm) or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work, where Class CC1 is indicated.
   d. Burning rate of 2.5 in./min. (1.06 mm/s) or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work, where Class CC2 is indicated.
   e. Flame-spread index not less than that indicated when tested according to ASTM E 84.
3. Windborne-Debris-Impact Resistance: Provide exterior plastic glazing that passes basic **OR** enhanced, **as directed**,-protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than plastic glazing indicated for use on Project and shall be installed in same manner as indicated for use on Project.
   a. Large-Missile Test: For plastic glazing located within 30 feet (9.1 m) of grade.
   b. Small-Missile Test: For plastic glazing located more than 30 feet (9.1 m) above grade.
      OR
      Large-Missile Test: For all plastic glazing, regardless of height above grade.

B. Monolithic Acrylic Glazing

1. Plastic Glazing: Transparent acrylic sheet; ASTM D 4802, Category A-1 (cell cast) **OR** Category A-2 (continuously cast) **OR** Category B-1 (continuously manufactured), **as directed**, Finish 1 (smooth or polished), Type UVF (UV filtering).
   a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
   b. Color: Colorless **OR** As selected from manufacturer's full range, **as directed**.
   c. Combustibility Class: CC2.
   d. Provide safety glazing labeling.
2. Plastic Glazing: Coated, transparent acrylic sheet; ASTM D 4802, Category A-1 (cell cast) **OR** Category B-1 (continuously manufactured), **as directed**, Finish 3 (abrasion-resistant coating) with coating on one side **OR** both sides, **as directed**, Type UVF (UV filtering).
   a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
   b. Color: Colorless **OR** As selected from manufacturer's full range, **as directed**.
   c. Combustibility Class: CC2.
   d. Provide safety glazing labeling.

3. Plastic Glazing: Translucent acrylic sheet; ASTM D 4802, Category A-1 (cell cast) **OR** Category B-1 (continuously manufactured), **as directed**, Finish 1 (smooth or polished), Type UVF (UV filtering).
   a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
   b. Color: White, with visible light transmittance of not more than 50 percent for 0.117-inch-(2.9-mm-) thick sheet, measured according to ASTM D 1003 **OR** As selected from manufacturer's full range, **as directed**.
   c. Combustibility Class: CC2.
   d. Provide safety glazing labeling.
4. Plastic Glazing: Patterned acrylic sheet; ASTM D 4802, Category A-1 (cell cast), Finish 2 (patterned), Type UVF (UV filtering).
   a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
   b. Pattern: Matte finish **OR** As selected from manufacturer's full range, **as directed**.
   c. Color: Transparent colorless **OR** Translucent white **OR** As selected from manufacturer's full range, **as directed**.
   d. Combustibility Class: CC2.
   e. Provide safety glazing labeling.

C. Monolithic Polycarbonate Glazing
1. Plastic Glazing: Polycarbonate sheet; ASTM C 1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.
   a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
   b. Color: Transparent colorless **OR** As selected from manufacturer's full range, **as directed**.
   c. Combustibility Class: CC1.
   d. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
   e. Provide safety glazing labeling.
2. Plastic Glazing: Coated polycarbonate sheet; ASTM C 1349, Appendix X1, Type II (coated mar-resistant, UV stabilized), with coating on both sides.
   a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
   b. Color: Transparent colorless **OR** As selected from manufacturer's full range, **as directed**.
   c. Combustibility Class: CC1.
   d. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
   e. Provide safety glazing labeling.

D. Multiwalled Structured Polycarbonate Glazing
1. Multiwalled Structured Polycarbonate Sheet: Manufacturer's standard polycarbonate extruded shape with smooth, flat exterior surfaces and internal ribbing.
   a. Nominal Thickness: 5/16 inch (8 mm) **OR** 3/8 inch (10 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (20 mm) **OR** 1 inch (25 mm), **as directed**.
   b. Color: Transparent colorless **OR** As selected from manufacturer's full range, **as directed**.
   c. Combustibility Class: CC1 **OR** CC2, **as directed**.
   d. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.

E. Glazing Gaskets
1. Dense Compression Gaskets: Molded or extruded gaskets, EPDM, ASTM C 864 or silicone, ASTM C 1115; and of profile and hardness required to maintain watertight seal.
2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM or silicone gaskets complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal.

F. Glazing Sealants

1. General:
   a. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including plastic glazing products and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   b. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   c. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   d. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   OR
   Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
   OR
   Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   OR
   Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

G. Glazing Tapes
1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   a. AAMA 804.3 tape, where indicated.
   b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

H. Miscellaneous Glazing Materials
1. Compatibility: Provide products of material, size, and shape complying with requirements of manufacturers of plastic glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
3. Setting Blocks: EPDM or silicone as required for compatibility with glazing sealant and plastic glazing, and of hardness recommended by plastic glazing manufacturer for application indicated.
4. Compressible Filler Rods: Closed cell of waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5- to 10-psi (35- to 70-kPa) compression strength for 25 percent deflection.

1.3 EXECUTION

A. Examination
1. Examine plastic glazing framing, with glazing Installer present, for compliance with the following:

a. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
b. Minimum required face or edge clearances.
c. Effective sealing between joints of plastic glazing framing members.

2. Proceed with glazing only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean glazing channels and other framing members immediately before glazing. Remove coatings not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

C. Glazing, General

1. Comply with combined written instructions of manufacturers of plastic glazing materials, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publication.
2. Glazing channel dimensions indicated on Drawings are designed to provide the necessary bite on plastic glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust plastic glazing lites during installation to ensure that bite is equal on all sides.
3. Sand or scrape cut edges of plastic glazing to provide smooth edges, free of chips and hairline cracks.
4. Remove burrs and other projections from glazing channel surfaces.
5. Protect plastic glazing surfaces from abrasion and other damage during handling and installation, according to the following requirements:
   a. Retain plastic glazing manufacturer's protective covering or protect by other methods according to plastic glazing manufacturer's written instructions.
   b. Remove covering at border of each piece before glazing; remove remainder of covering immediately after installation where plastic glazing will be exposed to sunlight or where other conditions make later removal difficult.
   c. Remove damaged plastic glazing sheets from Project site and legally dispose of off-site. Damaged plastic glazing sheets are those containing imperfections that, when installed, result in weakened glazing and impaired performance and appearance.
6. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
7. Install elastomeric setting blocks in sill channels, sized and located to comply with referenced glazing publication, unless otherwise instructed by plastic glazing manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
8. Provide edge blocking to comply with referenced glazing publication unless otherwise instructed by plastic glazing manufacturer.
9. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
10. Square cut wedge-shaped gaskets at corners and install gaskets as recommended in writing by gasket manufacturer to prevent corners from pulling away; seal corner and butt joints with sealant recommended by gasket manufacturer.

D. Tape Glazing

1. Install tapes continuously, but not in one continuous length. Do not stretch tapes to make them fit opening.
2. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
3. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant recommended by tape manufacturer.
4. Do not remove release paper from tape until immediately before each lite is installed.
5. Apply heel bead of glazing sealant.

6. Center plastic glazing lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
7. Apply cap bead of glazing sealant over exposed edge of tape.

E. Gasket Glazing (Dry)
1. Fabricate compression gaskets in lengths recommended in writing by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
2. Insert soft compression gasket between plastic glazing and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
3. Center plastic glazing lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in plastic glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
4. Install gaskets so they protrude past face of glazing stops.

F. Sealant Glazing (Wet)
1. Install continuous spacers between plastic glazing lites and glazing stops to maintain plastic glazing face clearances and to prevent sealant from extruding into glazing channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to plastic glazing and channel surfaces.
3. Tool exposed surfaces of sealants to provide a substantial wash away from plastic glazing.

G. Protecting And Cleaning
1. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.
2. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.
3. Wash plastic glazing on both faces before date scheduled for inspections intended to establish date of Final Completion in each area of Project. Wash plastic glazing according to plastic glazing manufacturer's written instructions.

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Task	Specification	Specification Description
08 85 00 00	08 44 13 00	Glazed Aluminum Curtain Walls
08 85 00 00	08 44 13 00a	Structural-Sealant-Glazed Curtain Walls
08 85 00 00	08 44 13 00b	Sloped Glazing Assemblies
08 87 13 00	07 42 13 19	Glazing

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SECTION 08 87 23 16 - FRAGMENT RETENTION FILM FOR GLASS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of fragment retention film for glass. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For each type of product indicated.
3. Test Reports: Certified test reports including analysis and interpretation of test results. Each report shall identify the manufacturer, the specific product name, the film thickness, the adhesive type and thickness, and the glass type and thickness. Test reports shall clearly identify the methods used and shall include the results recorded.
4. Certificates: On applications where the film will contact the glazing beads or gaskets, a certificate from the Contractor stating that the glazing compounds and gaskets are compatible with the fragment retention film and adhesive.

C. Delivery, Storage, And Handling
1. Deliver, store, and handle in accordance with the manufacturer's recommendations. Glass, including glass in windows or doors, that has the film factory applied shall be stored in a dry location free of dust, water, and other contaminants. Glass with factory applied film shall be delivered, stored, and handled so that the film is not damaged, scratched, or abraded and shall be stored in a manner which permits easy access for inspection and handling. Each roll of film shall have a tamperproof label containing full details of the roll and the batch number.

D. Warranty
1. Provide a 5 year warranty for fragment retention film material. The warranty shall provide for replacement of film if cracking, crazing, peeling, or inadequate adhesion occurs.

1.2 PRODUCTS

A. Standard Products: Fragment retention film shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

B. Fragment Retention Film: Fragment retention film shall be polyester, polyethylene terephthalate, or a composite. Fragment retention film shall be optically clear and free of waves, distortions, impurities, and adhesive lines. The film may be a single layer or laminated. Lamination of the film shall only occur at the factory of the fragment retention film manufacturer. The film shall include an abrasion resistant coating on the surface that does not receive the film adhesive. Fragment retention film shall be a minimum thickness of 0.004 inch (0.10 mm), as required to meet Project requirements, and shall be clear **OR** tinted, **OR** reflective, **as directed**. The film shall be supplied with an optically clear weatherable pressure sensitive adhesive. The adhesive shall contain ultraviolet inhibitors to protect the film for its required life and shall limit ultraviolet transmission to not more than 8 percent of the radiation between 300 and 380 nanometers. The adhesive shall not be water activated.
1. Impact Performance: Test fragment retention film for impact in accordance with ANSI Z97.1 or 16 CFR 1201.

2. Tensile Strength: The fragment retention film samples tested shall exhibit a minimum tensile strength at break of 25,000 psi (172.4 MPa) when tested in accordance with ASTM D882, Method A.
3. Peel Strength: The fragment retention film shall exhibit a minimum peel strength of 5.3 pounds/inch (930 N/m) for 0.004 inch (0.10 mm) thick film when tested in accordance with ASTM D3330, Method A.
4. Surface Abrasion: The fragment retention film shall exhibit a change in haze not to exceed 3.2 percent following 100 turns, using 500-gram weights on a CS 10F abrasive wheel when tested in accordance with ASTM D1044.
5. Flame Spread and Smoke Density: The fragment retention film shall exhibit a flame spread index not exceeding 25 and a smoke density index not exceeding 100 when tested in accordance with ASTM E84.

1.3 EXECUTION

A. Surface Preparation: The glass surface to which the fragment retention film is to be applied shall be cleaned of paint, foreign compounds, smears, and spatters. After the initial cleaning, the surface to receive the film shall be further cleaned in accordance with the film manufacturer's instructions.

B. Application: Provide fragment retention film on window and door glass where indicated. After surface preparation, apply the fragment retention film in accordance with the manufacturer's recommendations and instructions. Apply film to the interior (room) side of the glass for both single and double glazed sheets, unless otherwise indicated. Multiple applications of film to achieve specified thicknesses will not be allowed. The film shall not be applied if there are visible dust particles in the air, if there is frost on the glazing, or if any room condition such as temperature and humidity do not meet the manufacturer's instructions. After film application, maintain room conditions as required by the manufacturer's instructions to allow for proper curing of the adhesive.

1. Application to New Glass Before Glazing: Apply fragment retention film so that it extends edge to edge of the glass sheet. Set the film reinforced glass into the frame with glazing compounds or gaskets as specified in Division 08 Section "Glazing". When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility. The Contractor shall be responsible for delivery of the fragment retention film to the appropriate location for application. Coordinate fragment retention film application and curing with the glass supplier and window or door manufacturer prior to glazing installation.
2. Application to Existing Glass Involving Dismantlement: Remove the existing glazing compound, gaskets, and/or stops as required to expose the existing glass pane. If necessary, remove the glass so that the film can be applied. Apply the film so that it extends edge to edge of the glass sheet. Install existing gaskets and/or stops and replace any removed glazing compounds with new glazing compounds. Scrap removed glazing compounds. Glazing compounds shall be in accordance with GANA Sealant Manual. Glazing methods shall be in accordance with GANA Glazing Manual. When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility. Replace and reinstall any damaged or broken glazing and gaskets in kind.
3. Application to Existing Glass Without Dismantlement: Apply fragment retention film so that it extends to within 1/16-inch (1.6 mm), with a maximum of 1/8 inch (3 mm), of the edge of the visible glass area.
4. Application to Existing Glass and Frame Without Dismantlement: Apply fragment retention film past the edge of the visible glass and extend onto the frame. Amount of film overlap, edge connection to the frame, and adhesive for adhering film to frame shall be as recommended by the film manufacturer. When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility.
5. Splicing: Splices or seams in fragment retention film shall be permitted only when a sheet of glass has a dimension exceeding 58 inches (1.475 m) in both directions. All seams shall be

applied with a minimum overlap of 1/4 inch (6 mm) unless submitted test reports indicate impact performance is not diminished when seam is applied with a different overlap or a gap.

C. Cleaning: Clean the fragment retention film in accordance with the manufacturer's instructions.

END OF SECTION 08 87 23 16

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SECTION 08 88 53 00 - SECURITY GLAZING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of material for security glazing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes glazing for the following products and applications and of the following types:
   a. Products and applications specified in other Sections where glazing requirements are specified by reference to this Section:
      1) Steel detention and Steel doors.
      2) Glazed entrances.
      3) Storefront framing.
      4) Interior borrowed lites.
      5) Glazed curtain walls.
      6) Sloped glazing.
      7) Security, Detention, Aluminum and Steel windows.
   b. Security Glazing Types:
      1) Monolithic polycarbonate.
      2) Laminated glass.
      3) Laminated polycarbonate.
      4) Glass-clad polycarbonate.
      5) Laminated glass and polycarbonate.
      6) Insulating security glazing.
      7) Air-gap security glazing.

C. Definitions
1. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.
2. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

D. Performance Requirements
1. General:
   a. Installed security glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.
   b. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.
2. Delegated Design: Design security glazing, including comprehensive engineering analysis by a qualified professional engineer.
   a. Design Procedure for Glass: Design according to ASTM E 1300 **OR** ICC's 2003 International Building Code, **as directed**.
   b. Design Wind Pressures: As indicated on Drawings.
      OR
      Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
      2) Importance Factor.

3) Exposure Category: B **OR** C **OR** D, **as directed**.

c. Design Snow Loads: As indicated on Drawings **OR as directed**.

d. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

e. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:

1) Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.

2) Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.

3) Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.

f. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.

g. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Preconstruction Testing

1. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.

a. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

b. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.

c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.

d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

e. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

F. Submittals

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

2. LEED Submittal:

a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.

3. Security Glazing Samples: For each type of security glazing; 12 inches (300 mm) square.

4. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, **as directed**.

5. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

6. Delegated-Design Submittal: For security glazing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

7. Qualification Data: For installers, manufacturers of insulating security glazing with sputter-coated, low-e coatings, glazing testing agency and sealant testing agency.

8. Product Certificates: For each type of product indicated, from manufacturer.
9. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of security glazing, glazing sealant and glazing gasket.
   a. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
10. Preconstruction adhesion and compatibility test reports.
11. Warranties: Sample of special warranties.

G. Quality Assurance
1. Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings: A qualified insulating glazing manufacturer who is approved and certified, **as directed**, by coated-glass manufacturer.
2. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
3. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
4. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same type of lites, plies, interlayers, and spacers for each security glazing type indicated.
   a. Source Limitations for Tinted Glass: Obtain tinted glass from single source from single primary glass manufacturer for each tint color indicated.
5. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.
6. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   a. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
   b. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   c. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   d. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
7. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.
8. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC **OR** another certification agency acceptable to authorities having jurisdiction **OR** manufacturer, **as directed**. Label shall indicate manufacturer's name, type of glazing, thickness, and safety glazing standard with which glazing complies.
9. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
10. Preinstallation Conference: Conduct conference at Project site.

H. Delivery, Storage, And Handling
1. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
2. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

I. Project Conditions
1. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

J. Coordination
1. Coordinate dimensions, including thickness, of security glazing with dimensions of construction that receives security glazing.

K. Warranty
1. Manufacturer's Special Warranty for Coated Glass: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated glass that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   a. Warranty Period: 10 years from date of Final Completion.
2. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated glass that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
3. Manufacturer's Special Warranty for Polycarbonate Sheet: Manufacturer's standard form in which glazing manufacturer agrees to replace polycarbonate sheet that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to maintaining and cleaning polycarbonate sheet contrary to manufacturer's written instructions. Defects include yellowing and loss of light transmission.
   a. Warranty Period: 10 years from date of Final Completion.
4. Manufacturer's Special Warranty for Laminated Polycarbonate: Manufacturer's standard form in which laminated polycarbonate manufacturer agrees to replace laminated polycarbonate that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to maintaining and cleaning laminated polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.
   a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
5. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer's standard form in which glass-clad polycarbonate manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
   a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
6. Manufacturer's Special Warranty for Laminated Glass and Polycarbonate: Manufacturer's standard form in which laminated-glass-and-polycarbonate manufacturer agrees to replace laminated glass and polycarbonate that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass and polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
   a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.

7. Manufacturer's Special Warranty on Insulating Security Glazing: Manufacturer's standard form in which insulating security glazing manufacturer agrees to replace insulating security glazing that deteriorates within specified warranty period. Deterioration is defined as defects in individual lites developed from normal use or failure of hermetic seal under normal use. Deterioration does not include defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions.
   a. Defects in coated glass lites include peeling, cracking, and other indications of deterioration in coating.
   b. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   c. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
   d. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.
   e. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Security Glazing, General
1. Thickness: Where thickness is indicated, it is a minimum. Provide security glazing in thicknesses as needed to comply with requirements indicated.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
3. Fire-Test-Response Characteristics of Plastic Sheets: As determined by testing plastic sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.
   a. Self-ignition temperature of 650 deg F (343 deg C) or more when tested per ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
   b. Smoke-developed index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested per ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
   c. Burning extent of 1 inch (25 mm) **OR** rate of 2.5 in./min. (1.06 mm/s), **as directed**, or less when tested per ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work.
4. Windborne-Debris-Impact Resistance: Provide exterior security glazing that passes basic **OR** enhanced, **as directed**,-protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than security glazing indicated for use on the Project and shall be installed in same manner as indicated for use on the Project.
   a. Large-Missile Test: For security glazing located within 30 feet (9.1 m) of grade.
   b. Small-Missile Test: For security glazing located more than 30 feet (9.1 m) above grade.
      OR
      Large-Missile Test: For all security glazing, regardless of height above grade.
5. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on products of construction indicated and on procedures indicated below:
   a. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   b. Solar-Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   c. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

B. Glass Products
   1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
   2. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
      a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
      b. For heat-strengthened float glass, comply with requirements for Kind HS.
      c. For fully tempered float glass, comply with requirements for Kind FT.
      d. For uncoated glass, comply with requirements for Condition A.
      e. For coated vision glass, comply with requirements for Condition C (other coated glass).
   3. Chemically Strengthened Glass: Annealed float glass chemically strengthened to comply with ASTM C 1422, Surface Compression Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5, **as directed**, and Case Depth Level A **OR** Level B **OR** Level C **OR** Level D **OR** Level E **OR** Level F, **as directed**.
   4. Reflective-Coated Vision Glass: ASTM C 1376, Kind CV (coated vision glass), coated by pyrolytic process **OR** vacuum deposition (sputter-coating) process, **as directed**, and complying with other requirements specified.

C. Laminated Glass
   1. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
      a. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
      b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
      c. Interlayer Color: Clear unless otherwise indicated.
   2. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph, and with other requirements specified.
      a. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:
         1) Polyvinyl butyral interlayer.
         2) Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
         3) Ionoplast interlayer.
         4) Cast-in-place and cured-transparent-resin interlayer.
         5) Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.
      b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
      c. Interlayer Color: Clear unless otherwise indicated.

D. Polycarbonate Security Glazing
   1. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.
   2. Laminated Polycarbonate: Polycarbonate sheets laminated with clear urethane interlayer that complies with ASTM C 1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C 1349 for maximum allowable laminating process blemishes and haze.
   3. Glass-Clad Polycarbonate: ASTM C 1349, and other requirements specified.

a. Provide glass-clad polycarbonate that complies with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified.

4. Laminated Glass and Polycarbonate: ASTM C 1349, and other requirements specified.
   a. Provide laminated glass and polycarbonate that complies with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified.

E. Spall-Resistant Film
1. Spall-Resistant Film: Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.
2. Laminating Process: Laminate spall-resistant film to glazing assemblies in factory to produce laminated lites free of foreign substances, air, and glass pockets.

F. Insulating Security Glazing
1. Insulating Security Glazing: Factory-assembled units consisting of sealed lites separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
   a. Sealing System: Dual seal, with manufacturer's standard **OR** polyisobutylene and polysulfide **OR** polyisobutylene and silicone **OR** polyisobutylene and hot-melt butyl **OR** polyisobutylene and polyurethane, **as directed**, primary and secondary.
   b. Spacer: Manufacturer's standard spacer material and construction **OR** Aluminum with mill or clear anodic finish **OR** Aluminum with black, color anodic finish **OR** Aluminum with bronze, color anodic finish **OR** Aluminum with powdered metal paint finish in color selected **OR** Galvanized steel **OR** Stainless steel **OR** Polypropylene-covered stainless steel in color selected **OR** Thermally broken aluminum **OR** Nonmetallic laminate **OR** Nonmetallic tube, **as directed**.
   c. Desiccant: Molecular sieve or silica gel, or blend of both.

G. Air-Gap Security Glazing
1. Air-Gap Security Glazing: Factory-assembled units consisting of sealed lites separated by a dehydrated interspace and complying with other requirements specified.
   a. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   b. Spacer Specifications: Manufacturer's standard rigid, **as directed**, spacer material and construction.

H. Glazing Gaskets
1. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   a. Neoprene complying with ASTM C 864.
   b. EPDM complying with ASTM C 864.
   c. Silicone complying with ASTM C 1115.
   d. Thermoplastic polyolefin rubber complying with ASTM C 1115.
2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   a. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

I. Glazing Sealants
1. General:
   a. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

b. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
c. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
d. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

2. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
3. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
4. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
5. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

J. Glazing Tapes
1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   a. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   b. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

K. Miscellaneous Glazing Materials
1. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
3. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
4. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
5. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).
6. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

L. Fabrication Of Security Glazing
1. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

M. Laminated-Glass Security Glazing Types
1. Security Glazing: Clear laminated glass **OR** Tinted laminated glass **OR** Clear reflective-coated laminated glass **OR** Tinted reflective-coated laminated glass, **as directed**.

a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.

b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.

c. Blast Resistance:
1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
2) Peak Pressure: as directed by the Owner.
3) Positive Phase Impulse: as directed by the Owner.

d. Number of Plies: Two **OR** Three, **as directed**.

e. Overall Unit Thickness: as directed by the Owner.

f. Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.

g. Core Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.

h. Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.

i. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm)\, **as directed**.

j. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray **as directed**.

k. Tinted Glass Location: Outer ply.

l. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.

m. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.

n. Overall Visible Light Transmittance: as directed by the Owner.

o. Outdoor Visible Reflectance: as directed by the Owner. Winter Nighttime U-Factor: as directed by the Owner.

p. Summer Daytime U-Factor: as directed by the Owner.

q. Solar Heat-Gain Coefficient: as directed by the Owner.

r. Provide safety glazing labeling.

2. Security Glazing: Tinted reflective-coated, **as directed**, laminated glass with clear glass and tinted interlayer.

a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.

b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.

c. Blast Resistance:
   1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
      OR
      Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
   2) Peak Pressure: as directed by the Owner.
   3) Positive Phase Impulse: as directed by the Owner.
d. Number of Plies: Two **OR** Three, **as directed**.
e. Overall Unit Thickness: as directed by the Owner.
f. Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
g. Core Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
h. Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
i. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
j. Interlayer Color: Clear **OR** Blue-green **OR** Bronze light **OR** Gray, **as directed**.
k. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
l. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
m. Overall Visible Light Transmittance: as directed by the Owner.
n. Outdoor Visible Reflectance: as directed by the Owner. Winter Nighttime U-Factor: as directed by the Owner.
o. Summer Daytime U-Factor: as directed by the Owner.
p. Solar Heat-Gain Coefficient: as directed by the Owner. Provide safety glazing labeling.

N. Monolithic Polycarbonate Security Glazing Types
1. Security Glazing: Monolithic polycarbonate with mar-resistant coating on both surfaces.
   a. Detention Security Grade: Grade 4 per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
      OR
      Thickness: 3/8 inch (9.25 mm) **OR** 1/2 inch (12.7 mm), **as directed**.

O. Laminated-Polycarbonate Security Glazing Types
1. Security Glazing: Laminated polycarbonate.
   a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
   b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
      OR
      Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
   c. Blast Resistance:
      1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
         OR
         Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
      2) Peak Pressure: as directed by the Owner.
      3) Positive Phase Impulse: as directed by the Owner.
   d. Number of Plies: Two **OR** Three **OR** Four, **as directed**.
   e. Overall Unit Thickness: as directed by the Owner.

f. Outer and Inner Plies: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
g. Core Ply **OR** Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
h. Interlayer Thicknesses: 0.025 inch (0.635 mm).

P. Glass-Clad Polycarbonate Security Glazing Types
1. Security Glazing: Clear symmetrical glass-clad polycarbonate **OR** Tinted symmetrical glass-clad polycarbonate **OR** Clear reflective-coated symmetrical glass-clad polycarbonate **OR** Tinted reflective-coated symmetrical glass-clad polycarbonate, **as directed**.
a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
d. Blast Resistance:
1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
2) Peak Pressure: as directed by the Owner.
3) Positive Phase Impulse: as directed by the Owner.
e. Overall Unit Thickness: as directed by the Owner. Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
f. Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
1) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
2) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
g. Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
h. Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
i. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
j. Tinted Glass Location: Outer ply.
k. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
l. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
m. Overall Visible Light Transmittance: as directed by the Owner.
n. Outdoor Visible Reflectance: as directed by the Owner.
o. Winter Nighttime U-Factor: as directed by the Owner.
p. Summer Daytime U-Factor: as directed by the Owner.

q. Solar Heat-Gain Coefficient: as directed by the Owner.
r. Provide safety glazing labeling.

Q. Laminated-Glass-And-Polycarbonate Security Glazing Types
1. Security Glazing: Nonsymmetrical clear **OR** tinted **OR** reflective-coated, **as directed**, laminated glass and polycarbonate with glass plies on the attack or threat side and polycarbonate plies on the witness side.
a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **a directed**, per UL 752.
d. Blast Resistance:
1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
2) Peak Pressure: as directed by the Owner.
3) Positive Phase Impulse: as directed by the Owner.
e. Overall Unit Thickness: as directed by the Owner.
f. Makeup:
1) Outer Glass Ply: 3-mm heat-strengthened float glass.
2) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
3) First Inner Glass Ply: 12-mm, **as directed**, float glass.
4) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
5) Second Inner Glass Ply: 10-mm, **as directed**, float glass.
6) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
7) Inner Polycarbonate Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, Type I (standard, UV-stabilized) polycarbonate.
8) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
9) Outer Polycarbonate Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, Type II (coated, mar-resistant, UV-stabilized) polycarbonate.
g. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
h. Tinted Glass Location: Outer glass ply.
i. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
j. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
k. Overall Visible Light Transmittance: as directed by the Owner.
l. Outdoor Visible Reflectance: as directed by the Owner.

m. Winter Nighttime U-Factor: as directed by the Owner.
n. Summer Daytime U-Factor: as directed by the Owner.
o. Solar Heat-Gain Coefficient: as directed by the Owner.
p. Provide safety glazing labeling.

R. Insulating Security Glazing Types
1. Security Glazing: Clear insulating security glazing **OR** Tinted insulating security glazing **OR** Reflective-coated, clear insulating security glazing **OR** Reflective-coated, tinted insulating security glazing, **as directed**. Outdoor lite is monolithic glass and indoor lite is glass-clad polycarbonate.
a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
b. Overall Unit Thickness: as directed by the Owner.
c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
d. Indoor Lite: Glass-clad polycarbonate.
1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
2) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
3) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
e. Interspace Content: Air **OR** Argon, **as directed**.
f. Interspace Dimension: as directed by the Owner.
g. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
h. Tinted Glass Location: Outdoor lite.
i. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
j. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
k. Overall Visible Light Transmittance: as directed by the Owner.
l. Outdoor Visible Reflectance: as directed by the Owner.
m. Winter Nighttime U-Factor: as directed by the Owner.
n. Summer Daytime U-Factor: as directed by the Owner.
o. Solar Heat-Gain Coefficient: as directed by the Owner.
p. Provide safety glazing labeling.
2. Security Glazing: Low-e-coated, clear insulating security glazing **OR** Low-e-coated, tinted insulating security glazing, **as directed**. Outdoor lite is monolithic glass and indoor lite is glass-clad polycarbonate.
a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
b. Overall Unit Thickness: as directed by the Owner.
c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
d. Indoor Lite: Glass-clad polycarbonate.
1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
2) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR

Multiple Core:

a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.

b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.

3) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.

e. Interspace Content: Air **OR** Argon, **as directed**.

f. Interspace Dimension: as directed by the Owner.

g. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.

h. Tinted Glass Location: Outer lite.

i. Low-E Coating: Pyrolytic on second surface **OR** Pyrolytic on third surface **OR** Sputtered on second surface **OR** Sputtered on third surface, **as directed**.

j. Overall Visible Light Transmittance: as directed by the Owner.

k. Winter Nighttime U-Factor: as directed by the Owner.

l. Summer Daytime U-Factor: as directed by the Owner.

m. Solar Heat-Gain Coefficient: as directed by the Owner..

n. Provide safety glazing labeling.

3. Security Glazing: Clear insulating security glazing **OR** Tinted insulating security glazing **OR** Reflective-coated, clear insulating security glazing **OR** Reflective-coated, tinted insulating security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is glass-clad polycarbonate with spall-resistant film on inside face.

a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.

b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.

OR

Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.

c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.

OR

Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.

d. Blast Resistance:

1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.

OR

Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.

2) Peak Pressure: as directed by the Owner.

3) Positive Phase Impulse: as directed by the Owner.

e. Overall Unit Thickness: as directed by the Owner.

f. Outdoor Lite: Laminated glass with two plies of heat-strengthened float glass **OR** three plies of heat-strengthened float glass **OR** two outer plies of heat-strengthened float glass and two inner plies of annealed float glass, **as directed**.

1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.

2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.

3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.

4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.

g. Indoor Lite: Glass-clad polycarbonate faced with a 0.037-inch- (0.94-mm-) thick, spall-resistant polyester film laminated to indoor face.
1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
2) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
3) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.

h. Interspace Content: Air **OR** Argon, **as directed**.
i. Interspace Dimension: as directed by the Owner.
j. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
k. Tinted Glass Location: Outer **OR** Inner, **as directed**, ply of outdoor lite.
l. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
m. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
n. Overall Visible Light Transmittance: as directed by the Owner.
o. Outdoor Visible Reflectance: as directed by the Owner.
p. Winter Nighttime U-Factor: as directed by the Owner.
q. Summer Daytime U-Factor: as directed by the Owner.
r. Solar Heat-Gain Coefficient: as directed by the Owner.
s. Provide safety glazing labeling.

4. Security Glazing: Low-e-coated, clear insulating security glazing **OR** Low-e-coated, tinted insulating security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is glass-clad polycarbonate with spall-resistant film on inside face.
a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
d. Blast Resistance:
1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
2) Peak Pressure: as directed by the Owner.
3) Positive Phase Impulse: as directed by the Owner.

e. Overall Unit Thickness: as directed by the Owner.
f. Outdoor Lite: Laminated glass with two plies of heat-strengthened float glass **OR** three plies of heat-strengthened float glass **OR** two outer plies of heat-strengthened float glass and two inner plies of annealed float glass, **as directed**.
   1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
   2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
   3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
   4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
g. Indoor Lite: Glass-clad polycarbonate faced with a 0.037-inch- (0.94-mm-) thick, spall-resistant polyester film laminated to indoor face.
   1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
   2) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
   3) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
      OR
      Multiple Core:
      a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
      b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
   4) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
h. Interspace Content: Air **OR** Argon, **as directed**.
i. Interspace Dimension: as directed by the Owner.
j. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
k. Tinted Glass Location: Outer lite.
l. Low-E Coating: Pyrolytic on second surface **OR** Pyrolytic on third surface **OR** Sputtered on second surface **OR** Sputtered on third surface, **as directed**.
m. Overall Visible Light Transmittance: as directed by the Owner.
n. Winter Nighttime U-Factor: as directed by the Owner.
o. Summer Daytime U-Factor: as directed by the Owner.
p. Solar Heat-Gain Coefficient: as directed by the Owner. Provide safety glazing labeling.

S. Air-Gap Security Glazing Types
1. Security Glazing: Clear air-gap security glazing **OR** Tinted air-gap security glazing **OR** Clear reflective-coated air-gap security glazing **OR** Tinted reflective-coated air-gap security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is laminated polycarbonate.
   a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
      OR
      Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
   b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
      OR
      Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
   c. Blast Resistance:

1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
2) Peak Pressure: as directed by the Owner.
3) Positive Phase Impulse: as directed by the Owner.

d. Overall Unit Thickness: as directed by the Owner.
e. Outdoor Lite: Laminated glass with two **OR** three, **as directed**, plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
f. Indoor Lite: Laminated polycarbonate with two **OR** three **OR** four, **as directed**, polycarbonate plies.
1) Overall Unit Thickness: as directed by the Owner.
2) Outer and Inner Plies: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
3) Core Ply **OR** Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
4) Interlayer Thicknesses: 0.025 inch (0.635 mm).
g. Air-Gap Dimension: as directed by the Owner.
h. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
i. Tinted Glass Location: Outer **OR** Inner, **as directed**, ply of outdoor lite.
j. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
k. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
l. Overall Visible Light Transmittance: as directed by the Owner..
m. Outdoor Visible Reflectance: as directed by the Owner.
n. Winter Nighttime U-Factor: as directed by the Owner.
o. Summer Daytime U-Factor: as directed by the Owner.
p. Solar Heat-Gain Coefficient: as directed by the Owner.
q. Provide safety glazing labeling.

2. Security Glazing: Low-e-coated, clear air-gap security glazing **OR** Low-e-coated, tinted air-gap security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is laminated polycarbonate.
a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
c. Blast Resistance:
1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR

Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
2) Peak Pressure: as directed by the Owner.
3) Positive Phase Impulse: as directed by the Owner.

d. Overall Unit Thickness: as directed by the Owner.
e. Outdoor Lite: Laminated glass with two **OR** three, **as directed**, plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
f. Indoor Lite: Laminated polycarbonate with two **OR** three **OR** four, **as directed**, polycarbonate plies.
1) Overall Unit Thickness: as directed by the Owner.
2) Outer and Inner Plies: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
3) Core Ply **OR** Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
4) Interlayer Thicknesses: 0.025 inch (0.635 mm).
g. Air-Gap Dimension: as directed by the Owner.
h. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
i. Tinted Glass Location: Outer **OR** Inner, **as directed**, ply of outdoor lite.
j. Low-E Coating: Pyrolytic on second surface **OR** Pyrolytic on third surface **OR** Sputtered on second surface **OR** Sputtered on third surface, **as directed**.
k. Overall Visible Light Transmittance: as directed by the Owner.
l. Winter Nighttime U-Factor: as directed by the Owner.
m. Summer Daytime U-Factor: as directed by the Owner.
n. Solar Heat-Gain Coefficient: as directed by the Owner.
o. Provide safety glazing labeling.

1.3 EXECUTION

A. Examination
1. Examine framing for security glazing, with Installer present, for compliance with the following:
a. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
b. Presence and functioning of weep system.
c. Minimum required face or edge clearances.
d. Effective sealing between joints of framing members.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

C. Glazing, General
1. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
2. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged

security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing, impair performance, or impair appearance.

3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
5. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
6. Provide spacers for security glazing lites where the length plus width is larger than 50 inches (1270 mm).
   a. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
   b. Provide 1/8-inch (3-mm) minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
7. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
8. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
9. Set coated security glazing with proper orientation so that coatings face exterior or interior as specified.
10. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
11. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

D. Tape Glazing
1. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.
2. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
3. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
4. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
5. Do not remove release paper from tape until just before each glazing unit is installed.
6. Apply heel bead of elastomeric sealant.
7. Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
8. Apply cap bead of elastomeric sealant over exposed edge of tape.

E. Gasket Glazing (Dry)
1. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
2. Insert soft compression gasket securely in place between glazing unit and frame or fixed stop, with joints miter cut and bonded together at corners.
3. Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal

without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

4. Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
5. Install gaskets so they protrude past face of glazing stops.

F. Sealant Glazing (Wet)

1. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.
3. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

G. Protection And Cleaning

1. Protect exterior security glazing from damage immediately after installation by attaching crossed streamers to framing held away from glazing unit. Do not apply markers to security glazing surfaces. Remove nonpermanent labels, and clean surfaces.
2. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer.
3. Examine security glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by security glazing manufacturer.
4. Remove and replace security glazing that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, or vandalism during construction period.
5. Wash security glazing on exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 08 88 53 00

Task	Specification	Specification Description
08 88 53 00	07 42 13 19	Glazing

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SECTION 08 90 00 00 - LOUVERS AND VENTS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for louvers and vents. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
   a. Fixed, extruded-aluminum and formed-metal louvers.
   b. Adjustable, extruded-aluminum and formed-metal louvers.
   c. Adjustable, extruded-aluminum and formed-metal insulated louvers.
   d. Fixed, formed-metal acoustical louvers.
   e. Wall vents (brick vents).

C. Definitions
1. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
2. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
3. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.
4. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
5. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

D. Performance Requirements
1. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
2. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
   a. Wind Loads:
      1) Determine loads based on pressures as indicated on Drawings.
      OR
      Determine loads based on a uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
3. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   a. Design earthquake spectral response acceleration, short period (Sds) for Project is **as directed.**
   b. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

6. Acoustic Performance: Provide acoustical louvers complying with ratings specified, as demonstrated by testing manufacturer's stock units identical to those specified, except for length and width for airborne sound-transmission loss according to ASTM E 90 **OR** outdoor-indoor sound-transmission loss according to ASTM E 966, **as directed**.

E. Submittals
1. Product Data: For each type of product indicated.
   a. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
2. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
3. Samples: For each type of metal finish required.
4. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Product Test Reports: Based on tests performed according to AMCA 500-L.

F. Quality Assurance
1. Welding: Qualify procedures and personnel according to the following:
   a. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   b. AWS D1.3, "Structural Welding Code - Sheet Steel."
   c. AWS D1.6, "Structural Welding Code - Stainless Steel."
2. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
3. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.2 PRODUCTS

A. Materials
1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
3. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.
4. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 (Z180) **OR** G90 (Z275), **as directed**, zinc coating, mill phosphatized.
5. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. 2B finish **OR** No. 2D finish **OR** No. 4 finish, with grain running parallel to length of blades and frame members **OR** No. 4 finish, with grain running perpendicular to length of blades and frame members **OR** No. 4 finish, with grain running perpendicular to length of blades and parallel to length of frame members **OR** No. 6 finish, **as directed**.
6. Fasteners: Use types and sizes to suit unit installation conditions.
   a. Use Phillips flat-head **OR** hex-head or Phillips pan-head **OR** tamper-resistant, **as directed**, screws for exposed fasteners unless otherwise indicated.
   b. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   c. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
   d. For fastening stainless steel, use 300 series stainless-steel fasteners.
   e. For color-finished louvers, use fasteners with heads that match color of louvers.
7. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
8. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

B. Fabrication, General

1. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
2. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   a. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated **OR** where indicated, **as directed**.
   b. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated **OR** where indicated, **as directed**.
3. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, **as directed**, to produce uniform appearance.
4. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   a. Frame Type: Channel **OR** Exterior flange **OR** Interior flange, **as directed**, unless otherwise indicated.
5. Include supports, anchorages, and accessories required for complete assembly.
6. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
   a. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
   b. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
   c. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
   d. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
7. Provide subsills made of same material as louvers **OR** extended sills, **as directed**, for recessed louvers.
8. Join frame members to each other and to fixed louver blades with fillet welds concealed from view **OR** welds, threaded fasteners, or both, as standard with louver manufacturer, **as directed**, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

C. Fixed, Extruded-Aluminum Louvers

1. Horizontal Storm-Resistant Louver:
   a. Louver Depth: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 7 inches (175 mm) **OR** 8 inches (200 mm) **OR** 9 inches (225 mm), **as directed**.
   b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
   c. Louver Performance Ratings:
      1) Free Area: Not less than 5.0 sq. ft. (0.46 sq. m) **OR** 6.0 sq. ft. (0.56 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.

3) Wind-Driven Rain Performance: Not less than 99 **OR** 95 **OR** 80, **as directed**, percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) **OR** 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s), **as directed**, at a core-area intake velocity of 300 fpm (1.5 m/s) **OR** 400 fpm (2.0 m/s) **OR** 500 fpm (2.5 m/s), **as directed**.

d. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2. Vertical Storm-Resistant Louver:
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 9 inches (225 mm) **OR** 12 inches (300 mm), **as directed**.
   b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
   c. Louver Performance Ratings:
      1) Free Area: Not less than 5.0 sq. ft. (0.46 sq. m) **OR** 6.0 sq. ft. (0.56 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
      3) Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) **OR** 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s), **as directed**, at a core-area intake velocity of 300 fpm (1.5 m/s) **OR** 400 fpm (2.0 m/s) **OR** 500 fpm (2.5 m/s), **as directed**.
   d. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
3. Horizontal, Drainable-Blade Louver:
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
   b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
   c. Mullion Type: Exposed.
   d. Louver Performance Ratings:
      1) Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m) **OR** 8.5 sq. ft. (0.79 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Point of Beginning Water Penetration: Not less than 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s) **OR** 1000 fpm (5.1 m/s) **OR** 1050 fpm (5.3 m/s) **OR** 1100 fpm (5.6 m/s), **as directed**.
      3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 700-fpm (3.6-m/s) **OR** 750-fpm (3.8-m/s) **OR** 800-fpm (4.1-m/s) **OR** 850-fpm (4.3-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
      4) Air Performance: Not more than 0.15-inch wg (37-Pa) static pressure drop at 900-fpm (4.6-m/s) **OR** 950-fpm (4.8-m/s) **OR** 1000-fpm (5.1-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
   e. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
4. Horizontal, Continuous-Line, Drainable-Blade Louver: Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only and with semirecessed mullions capable of collecting and draining water from blades.
   a. Louver Depth: 6 inches (150 mm).
   b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
   c. Louver Performance Ratings:
      1) Free Area: Not less than 7.8 sq. ft. (0.72 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Point of Beginning Water Penetration: Not less than 850 fpm (4.3 m/s).
      3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 800-fpm (4.1-m/s) free-area exhaust **OR** intake, **as directed**, velocity.
5. Horizontal, Sightproof, Drainable-Blade Louver:

a. Louver Depth: 5 inches (125 mm).
b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
c. Mullion Type: Exposed.
d. Louver Performance Ratings:
1) Free Area: Not less than 8.3 sq. ft. (0.77 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
2) Point of Beginning Water Penetration: Not less than 750 fpm (3.8 m/s) **OR** 950 fpm (4.8 m/s), **as directed**.
3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 550-fpm (2.8-m/s) free-area exhaust **OR** intake, **as directed**, velocity.

6. Horizontal, Nondrainable-Blade Louver:
a. Louver Depth: 2 inches (50 mm) **OR** 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
b. Blade Profile: Plain blade without **OR** Blade with, **as directed**, center baffle.
c. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
d. Mullion Type: Exposed **OR** Semirecessed **OR** Fully recessed, **as directed**.
e. Louver Performance Ratings:
1) Free Area: Not less than 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m) **OR** 8.5 sq. ft. (0.79 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
2) Point of Beginning Water Penetration: Not less than 700 fpm (3.6 m/s) **OR** 750 fpm (3.8 m/s) **OR** 800 fpm (4.1 m/s) **OR** 850 fpm (4.3 m/s) **OR** 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s), **as directed**.
3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 650-fpm (3.3-m/s) **OR** 700-fpm (3.6-m/s) **OR** 750-fpm (3.8-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.

7. Vertical, Sightproof, Louver:
a. Louver Depth: 4 inches (100 mm).
b. Blade Profile: Chevron **OR** Y **OR** Labyrinth, **as directed**,-shaped blade.
c. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
d. Blade Spacing: 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, o.c.
e. Mullion Type: Exposed **OR** Semirecessed **OR** Fully recessed, **as directed**.

D. Fixed, Formed-Metal Louvers
1. Horizontal, Drainable-Blade Louver:
a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
b. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
c. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
d. Mullion Type: Exposed.
e. Louver Performance Ratings:
1) Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m) **OR** 8.5 sq. ft. (0.79 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
2) Point of Beginning Water Penetration: Not less than 800 fpm (4.1 m/s) **OR** 850 fpm (4.3 m/s) **OR** 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 700-fpm (3.6-m/s) **OR** 750-fpm (3.8-m/s) **OR** 800-fpm (4.1-m/s) **OR** 850-fpm (4.3-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.

4) Air Performance: Not more than 0.15-inch wg (37-Pa) static pressure drop at 900-fpm (4.6-m/s) **OR** 950-fpm (4.8-m/s) **OR** 1000-fpm (5.1-m/s), **as directed**, free-area velocity.

f. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2. Horizontal, Nondrainable-Blade Louver:
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
   b. Blade Profile: Plain blade without **OR** Blade with, **as directed**, center baffle.
   c. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
   d. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
   e. Mullion Type: Exposed **OR** Semirecessed **OR** Fully recessed, **as directed**.
   f. Louver Performance Ratings:
      1) Free Area: Not less than 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Point of Beginning Water Penetration: Not less than 550 fpm (2.8 m/s) **OR** 600 fpm (3.0 m/s) **OR** 650 fpm (3.3 m/s) **OR** 700 fpm (3.6 m/s), **as directed**.
      3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 550-fpm (2.8-m/s) **OR** 600-fpm (3.0-m/s) **OR** 650-fpm (3.3-m/s) **OR** 700-fpm (3.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.

E. Adjustable, Extruded-Aluminum Louvers
1. Louver Construction and Operation: Provide adjustable louvers with extruded-aluminum frames and blades not less than 0.080-inch (2.03-mm) nominal thickness, and with operating mechanisms to suit louver sizes.
   a. Hand operation with push bars.
   b. Crank operation with removable-crank operator in sill or jamb.
   c. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
   d. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch **OR** 2-direction, 110-V, 60-Hz motor and limit switches, **as directed**; equipped with frame-mounted switch **OR** remote-mounted switch with indicator light **OR** terminals for controlling devices, **as directed**.
   e. Pneumatic piston operation for use with 80- to 100-psi (550- to 690-kPa) compressed air for 2-position **OR** modulating, **as directed**, operation; power open, power close with spring-return fail-safe, **as directed**.
2. Dual-Blade, Drainable-Blade, Adjustable Louver: Fixed drainable blades and adjustable plain blades combined in single frame.
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, overall.
   b. Louver Performance Ratings:
      1) Free Area: Not less than 6.0 sq. ft. (0.56 sq. m) **OR** 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Point of Beginning Water Penetration: Not less than 750 fpm (3.8 m/s) **OR** 800 fpm (4.1 m/s) **OR** 850 fpm (4.3 m/s) **OR** 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
      3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 750-fpm (3.8-m/s) **OR** 800-fpm (4.1-m/s) **OR** 850-fpm (4.3-m/s) **OR** 900-fpm (4.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
      4) Air Leakage: Not more than 1.5 cfm/sq. ft. (7.6 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.

c. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

3. Single-Blade, Adjustable Louver:
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
   b. Blade Type: Drainable **OR** Plain, **as directed**.
   c. Accessories: Equip louvers as follows:
      1) Vinyl blade-edge gaskets for each louver blade.
      2) Stainless-steel jamb seals **OR** vinyl blade-end gaskets, **as directed**.
   d. Louver Performance Ratings:
      1) Free Area: Not less than 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
      2) Point of Beginning Water Penetration: Not less than 500 fpm (2.5 m/s) **OR** 600 fpm (3.0 m/s) **OR** 700 fpm (3.6 m/s) **OR** 800 fpm (4.1 m/s) **OR** 900 fpm (4.6 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
      3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 500-fpm (2.5-m/s) **OR** 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s) **OR** 900-fpm (4.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
      4) Air Leakage: Not more than 3.5 cfm/sq. ft. (17.8 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.
   e. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

F. Adjustable, Formed-Metal Louvers
1. Louver Operation: Provide adjustable louvers with operating mechanisms to suit louver sizes.
   a. Hand operation with push bars.
   b. Crank operation with removable-crank operator in sill or jamb.
   c. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
   d. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch **OR** 2-direction, 110-V, 60-Hz motor and limit switches, **as directed**; equipped with frame-mounted switch **OR** remote-mounted switch with indicator light **OR** terminals for controlling devices, **as directed**.
   e. Pneumatic piston operation for use with 80- to 100-psi (550- to 690-kPa) compressed air for 2-position **OR** modulating, **as directed**, operation; power open, power close with spring-return fail-safe, **as directed**.
2. Dual-Blade, Drainable-Blade, Adjustable Louver: Fixed drainable blades and adjustable plain blades combined in single frame.
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, overall.
   b. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
   c. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
   d. Louver Performance Ratings:
      1) Air Leakage: Not more than 1.5 cfm/sq. ft. (7.6 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.
   e. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
3. Single-Blade, Adjustable Louver:
   a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
   b. Blade Type: Drainable **OR** Plain, **as directed**.
   c. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.

d. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
e. Accessories: Equip louvers as follows:
   1) Vinyl blade-edge gaskets for each louver blade.
   2) Stainless-steel jamb seals **OR** vinyl blade-end gaskets, **as directed**.
f. Louver Performance Ratings:
   1) Free Area: Not less than 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
   2) Point of Beginning Water Penetration: Not less than 500 fpm (2.5 m/s) **OR** 600 fpm (3.0 m/s) **OR** 700 fpm (3.6 m/s) **OR** 800 fpm (4.1 m/s) **OR** 900 fpm (4.6 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
   3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 500-fpm (2.5-m/s) **OR** 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s) **OR** 900-fpm (4.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
   4) Air Leakage: Not more than 3.5 cfm/sq. ft. (17.8 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.
g. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

G. Adjustable, Insulated Louvers
1. Louver Operation: Provide adjustable louvers with operating mechanisms to suit louver sizes.
   a. Hand operation with push bars.
   b. Crank operation with removable-crank operator in sill or jamb.
   c. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
   d. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch **OR** 2-direction, 110-V, 60-Hz motor and limit switches, **as directed**; equipped with frame-mounted switch **OR** remote-mounted switch with indicator light **OR** terminals for controlling devices, **as directed**.
   e. Pneumatic piston operation for use with 80- to 100-psi (550- to 690-kPa) compressed air for 2-position **OR** modulating, **as directed**, operation; power open, power close with spring-return fail-safe, **as directed**.
2. Adjustable, Insulated, Extruded-Aluminum Louver: Single-blade, adjustable louver with gasketed, insulated blades. Frames and blade frames have urethane thermal break. Frames are extruded aluminum, not less than 0.080-inch (2.03-mm) nominal thickness. Blade facings are aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
   a. Louver Depth: 6 inches (150 mm) **OR** 9 inches (225 mm), **as directed**.
   b. Insulation: Extruded-polystyrene foam, 2 inches (50 mm) thick **OR** Foamed-in-place polyurethane, **as directed**.
3. Adjustable, Insulated, Formed-Metal Louver: Single-blade, adjustable louver with gasketed, insulated blades.
   a. Louver Depth: 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**.
   b. Frame Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
   c. Frame Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
   d. Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.028 inch (0.71 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
   e. Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.025 inch (0.64 mm) **OR** 0.038 inch (0.95 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.

f. Insulation: Extruded-polystyrene foam, 1 inch (25 mm) thick **OR** Rigid, glass-fiber-board insulation, 1 inch (25 mm) thick **OR** Foamed-in-place polyurethane, 1/2 inch (13 mm) thick, **as directed**.

H. Fixed, Acoustical Louvers

1. Fixed, Formed-Metal Acoustical Louver: Louver with formed-metal blades filled on interior with mineral-fiber, rigid-board, acoustical insulation retained by perforated metal sheet of same material and finish as blade.
   a. Louver Depth: 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**.
   b. Frame Material: Extruded-aluminum or aluminum sheet, not less than 0.080-inch (2.03-mm) nominal thickness.
   c. Frame Material: Galvanized-steel sheet, not less than 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
   d. Blade Material: Aluminum sheet, not less than 0.063-inch (1.60-mm) **OR** 0.080-inch (2.03-mm), **as directed**, nominal thickness.
   e. Blade Material: Galvanized-steel sheet, not less than 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   f. Blade Shape: Straight **OR** Airfoil **OR** Chevron, **as directed**.
   g. Blade Angle: 45 degrees unless otherwise indicated.
   h. Blade Spacing: 6 inches (150 mm) o.c. for 6-inch- (150-mm-) deep louvers.
   i. Blade Spacing: 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**, o.c. for 8-inch- (200-mm-) deep louvers.
   j. Blade Spacing: 9 inches (225 mm) **OR** 12 inches (300 mm), **as directed**, o.c. for 12-inch- (300-mm-) deep louvers.
   k. Free Area: Not less than 4 sq. ft. (0.37 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
   l. Airborne Sound-Transmission Loss: STC 10 per ASTM E 413, determined by testing per ASTM E 90.
   m. Outdoor-Indoor Sound-Transmission Loss: OITC 10 per ASTM E 1332, determined by testing per ASTM E 966.

I. Louver Screens

1. General: Provide screen at each exterior louver **OR** louvers indicated, **as directed**.
   a. Screen Location for Fixed Louvers: Interior face.
   b. Screen Location for Adjustable Louvers: Interior **OR** Exterior, **as directed**, face unless otherwise indicated.
   c. Screening Type: Bird screening **OR** Bird screening except where insect screening is indicated **OR** Insect screening, **as directed**.
2. Secure screen frames to louver frames with stainless-steel machine screws **OR** machine screws with heads finished to match louver, **as directed**, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
3. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   a. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips, **as directed**.
   b. Finish: Same finish as louver frames to which louver screens are attached **OR** Mill finish unless otherwise indicated, **as directed**.
   c. Type: Rewirable frames with a driven spline or insert **OR** Non-rewirable, U-shaped frames, **as directed**.
4. Louver Screening for Aluminum Louvers:
   a. Bird Screening: Aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.
   b. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
   c. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.
   d. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

e. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

5. Louver Screening for Galvanized-Steel Louvers:
   a. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire.
   b. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
   c. Insect Screening: Galvanized steel, 18-by-14 (1.4-by-1.8-mm) mesh, 0.011-inch (0.28-mm) wire.
   d. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.
6. Louver Screening for Stainless-Steel Louvers:
   a. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
   b. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

J. Blank-Off Panels
1. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
   a. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
   b. Galvanized-steel sheet for galvanized-steel louvers, not less than 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
   c. Stainless-steel sheet for stainless-steel louvers, not less than 0.038-inch (0.95-mm) **OR** 0.050-inch (1.27-mm), **as directed**, nominal thickness, with grain running in same direction as grain of louver blades.
   d. Panel Finish: Same finish applied to louvers **OR** Same type of finish applied to louvers, but black color, **as directed**.
   e. Attach blank-off panels with clips **OR** sheet metal screws, **as directed**.
2. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
   a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
   b. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
   c. Metal Facing Sheets: Galvanized-steel sheet, not less than 0.028-inch (0.71-mm) nominal thickness.
   d. Metal Facing Sheets: Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness.
   e. Insulating Core: Rigid, glass-fiber-board insulation **OR** extruded-polystyrene foam, **as directed**.
   f. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch (2.03-mm) nominal thickness **OR** channel frames, **as directed**, with corners mitered and with same finish as panels.
   g. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
   h. Panel Finish: Same finish applied to louvers **OR** Same type of finish applied to louvers, but black color, **as directed**.
   i. Attach blank-off panels with clips **OR** sheet metal screws, **as directed**.

K. Wall Vents (Brick Vents)
1. Extruded-Aluminum Wall Vents:
   a. Extruded-aluminum louvers and frames, not less than 0.125-inch (3.18-mm) nominal thickness, assembled by welding; with 18-by-14- (1.4-by-1.8-mm-) mesh, aluminum insect screening on inside face; incorporating weep holes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction.

b. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
c. Finish: Mill finish.

2. Cast-Aluminum Wall Vents:
a. One-piece, cast-aluminum louvers and frames; with 18-by-14- (1.4-by-1.8-mm-) mesh, aluminum insect screening on inside face; incorporating integral waterstop on inside edge of sill; of load-bearing design and construction.
b. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
c. Finish: Mill finish.

L. Finishes, General
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

M. Aluminum Finishes
1. Finish louvers after assembly.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
a. Color: As selected from full range of industry colors and color densities.
4. Conversion-Coated Finish: AA-C12C42 (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating).
5. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below).
a. Organic Coating: Air-dried primer of not less than 2-mil (0.05-mm) dry film thickness.
6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
7. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
8. High-Performance Organic Finish: 3 **OR** 4, **as directed**,-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

N. Galvanized-Steel Sheet Finishes
1. Finish louvers after assembly.
2. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting

topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

O. Stainless-Steel Sheet Finishes

1. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

1.3 EXECUTION

A. Installation

1. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
2. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
3. Form closely fitted joints with exposed connections accurately located and secured.
4. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
5. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
6. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
7. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

B. Adjusting And Cleaning

1. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
2. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
3. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
4. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Owner, remove damaged units and replace with new units.

a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 90 00 00

Task	Specification	Specification Description
08 91 16 00	08 90 00 00	Louvers And Vents
08 95 13 00	01 22 16 00	No Specification Required
08 95 16 00	01 22 16 00	No Specification Required
08 95 16 00	05 50 00 00	Metal Fabrications
08 95 16 00	05 73 23 00	Miscellaneous Ornamental Metals

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SECTION 09 01 30 91 - CERAMIC TILE

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Ceramic tile.
b. Porcelain tile.
c. Stone thresholds.
d. Waterproof membrane.
e. Crack isolation membrane.
f. Tile backing panels.
g. Metal edge strips.

C. Definitions
1. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
2. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
3. Module Size: Actual tile size plus joint width indicated.
4. Face Size: Actual tile size, excluding spacer lugs.

D. Performance Requirements
1. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
a. Level Surfaces: Minimum 0.6.
b. Step Treads: Minimum 0.6.
c. Ramp Surfaces: Minimum 0.8.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
4. Samples:
a. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
OR
Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches

(300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
b. Full-size units of each type of trim and accessory for each color and finish required.
c. Stone thresholds in 6-inch (150-mm) lengths.
d. Metal edge strips in 6-inch (150-mm) lengths.
5. Qualification Data: For qualified Installer.
6. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
7. Product Certificates: For each type of product, signed by product manufacturer. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
8. Material Test Reports: For each tile-setting and -grouting product, special purpose tile and certified porcelain tile.

F. Quality Assurance
1. Source Limitations for Tile: Obtain tile of each type and color or finish **OR** tile of each type **OR** tile of each color or finish **OR** tile, **as directed**, from one source or producer.
a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
2. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
3. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
a. Stone thresholds.
b. Waterproof membrane.
c. Crack isolation membrane.
d. Joint sealants.
e. Cementitious backer units.
f. Metal edge strips.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
2. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
3. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
4. Store liquid materials in unopened containers and protected from freezing.
5. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

H. Project Conditions
1. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.2 PRODUCTS

A. Products, General
1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
a. Provide tile complying with Standard grade requirements unless otherwise indicated.

2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 1.2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
3. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
4. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
5. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

B. Tile Products
1. Tile Type: Factory-mounted unglazed **OR** glazed, **as directed**, ceramic mosaic tile.
   a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain, **as directed**.
   b. Module Size: 1 by 1 inch (25.4 by 25.4 mm) **OR** 1 by 2 inches (25.4 by 50.8 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
   c. Thickness: 1/4 inch (6.35 mm).
   d. Face: Plain **OR** Pattern of design indicated, **as directed**, with cushion edges.
   e. Surface (for unglazed tile): Smooth, without **OR** Slip-resistant, with, **as directed**, abrasive admixture.
   f. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
   g. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   h. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
      1) Base Cove: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
      2) Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
      3) Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
      4) Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
      5) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
      6) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
      7) External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
      8) External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.

9) Internal Corners: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
OR
Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

10) Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

2. Tile Type: Unglazed **OR** Glazed, **as directed**, square-edged quarry tile.
   a. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 3 inches (152 by 76 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm) **OR** 8 by 8 inches (203 by 203 mm), **as directed**.
   b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19 mm), **as directed**.
   c. Wearing Surface (for unglazed tile): Nonabrasive, smooth **OR** Abrasive aggregate embedded in surface, **as directed**.
   d. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
   e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   g. For furan-grouted quarry tile, precoat with temporary protective coating.
   h. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
      1) Base: Coved with surface bullnose top edge, **as directed**, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
      2) Wainscot Cap: Surface bullnose, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
      3) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
3. Tile Type: Unglazed **OR** Glazed, **as directed**, paver tile.
   a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain **OR** Natural clay or porcelain, **as directed**.
   b. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 7-3/4 by 3-7/8 inches (197 by 98 mm) **OR** 7-7/8 by 7-7/8 inches (200 by 200 mm) **OR** 11-13/16 by 11-13/16 inches (300 by 300 mm) **OR** 165 by 333 mm **OR** 200 by 250 mm **OR** 250 by 250 mm **OR** 165 by 333 mm **OR** 333 by 333 mm **OR** 400 by 400 mm, **as directed**.
   c. Thickness: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
   d. Face: Plain with square or cushion edges **OR** Plain with square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with square or cushion edges **OR** As indicated, **as directed**.
   e. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
   f. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   g. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
4. Tile Type: Glazed wall tile **OR** Decorative thin wall tile, **as directed**.

a. Module Size: 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 4-1/4 inches (152 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 200 by 200 mm **OR** 250 by 250 mm **OR** 200 by 300 mm, **as directed**.
b. Thickness: 5/16 inch (8 mm).
c. Face: Plain with modified square edges or cushion edges **OR** Plain with modified square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with manufacturer's standard edges, **as directed**.
d. Finish: Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
g. Mounting: Factory, back mounted.
h. Mounting: Pregrouted sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
1) Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 3-3/4 inches (152 by 95 mm), **as directed**.
2) Base for Thin-Set Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
3) Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
4) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
5) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
6) External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
7) External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
8) Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

5. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.
a. One soap holder with grab handle, **as directed**, for each shower and tub indicated.
b. One paper holder at each water closet.
c. Color and Finish: Match adjoining glazed wall tile **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** White, bright glaze, **as directed**.

C. Thresholds
1. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
a. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
2. Granite Thresholds: ASTM C 615, with polished **OR** honed, **as directed**, finish.

a. Description: Uniform, fine **OR** medium, **as directed**,-grained, white **OR** gray **OR** black, **as directed**, stone without veining.
OR
Description: Match sample.

3. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 **OR** 12, **as directed**, per ASTM C 1353 or ASTM C 241 and with honed finish.
a. Description: Uniform, fine- to medium-grained white stone with gray veining.
OR
Description: Match sample.

4. Slate Thresholds: ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with fine, even grain and honed finish.
a. Description: Uniform, black **OR** blue-black **OR** gray **OR** blue-gray **OR** green, **as directed**, stone and unfading.
OR
Description: Match sample.

D. Tile Backing Panels
1. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** As indicated, **as directed**.
2. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** As indicated, **as directed**.

E. Waterproof Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
5. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
6. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
7. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
8. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
9. Urethane Waterproofing and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

F. Crack Isolation Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard **OR** high, **as directed**, performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.

4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
5. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
6. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
7. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
8. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
9. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
10. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

G. Setting Materials
1. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
   a. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
   b. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 1064 and ASTM A 82 except for minimum wire size.
   c. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
      1) Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
      2) Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
      3) Configuration over Studs and Furring: Flat.
      4) Configuration over Solid Surfaces: Self furring.
      5) Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
   d. Latex Additive: Manufacturer's standard, acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
2. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
   a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
3. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
   a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
      OR
      Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
   b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
4. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
   a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
      OR
      Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
5. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thin Set): ANSI A118.11.
   a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

6. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
7. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler.
8. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Grout Materials
1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
2. Standard Cement Grout: ANSI A118.6.
3. Polymer-Modified Tile Grout: ANSI A118.7.
   a. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
      OR
      Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
4. Water-Cleanable Epoxy Grout: ANSI A118.3.
   a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
5. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler.
6. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

I. Elastomeric Sealants
1. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
   a. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
3. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
4. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
5. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

J. Miscellaneous Materials
1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications;

half-hard brass **OR** white zinc alloy **OR** nickel silver **OR** stainless-steel, ASTM A 666, 300 Series, **as directed**, exposed-edge material.

3. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
   b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
4. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
5. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

K. Mixing Mortars And Grout
1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

1.3 EXECUTION

A. Examination
1. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   a. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   b. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      1) Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      2) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
2. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
3. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from

other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

4. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

C. Tile Installation

1. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   a. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
      1) Exterior tile floors.
      2) Tile floors in wet areas.
      3) Tile swimming pool decks.
      4) Tile floors in laundries.
      5) Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
      6) Tile floors composed of rib-backed tiles.
2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
5. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   a. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
   b. Porcelain Tile: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm)**, as directed.**
   c. Quarry Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
   d. Paver Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
   e. Glazed Wall Tile: 1/16 inch (1.6 mm).
   f. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
6. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
7. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
8. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
   a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).

b. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing or crack isolation membrane with elastomeric sealant.

9. Metal Edge Strips: Install at locations indicated **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated, **as directed**.

10. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

D. Tile Backing Panel Installation

1. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

E. Waterproofing Installation

1. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
2. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

F. Crack Isolation Membrane Installation

1. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
2. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

G. Cleaning And Protecting

1. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   a. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   b. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   c. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
2. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
3. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
4. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

H. Exterior Tile Installation Schedule

1. Exterior Floor Installations:
   a. Tile Installation F101: Cement mortar bed (thickset) bonded to concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated, **as directed**; TCA F101 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
      1) Tile Type: as directed by the Owner.

2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

b. Tile Installation F102: Thin-set mortar on concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated, **as directed**; TCA F102.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

2. Exterior Wall Installations, Masonry or Concrete:
a. Tile Installation W201: Cement mortar bed (thickset) on metal lath over waterproof membrane; TCA W201 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed,** portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

b. Tile Installation W202: Thin-set mortar; TCA W202.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

I. Interior Tile Installation Schedule
1. Interior Floor Installations, Concrete Subfloor:
a. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

b. Tile Installation F112: Cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

c. Tile Installation F113: Thin-set mortar; TCA F113.
1) Tile Type: as directed by the Owner.

2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

d. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; epoxy **OR** furan, **as directed**, grout; TCA F114 and ANSI A108.1B.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **s directed**, grout.

e. Tile Installation F115: Thin-set mortar; epoxy **OR** furan, **as directed**, grout; TCA F115.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.

f. Tile Installation F116: Organic adhesive **OR** Water-cleanable, tile-setting epoxy, **as directed**; TCA F116.
1) Tile Type: as directed by the Owner.
2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

g. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

h. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Polymer-modified sanded **OR** unsanded, **as directed**, grout.

i. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

j. Tile Installation F131: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F131.
1) Tile Type: as directed by the Owner.
2) Grout: Water-cleanable epoxy grout.

k. Tile Installation F132: Water-cleanable, tile-setting epoxy on cured cement mortar bed bonded to concrete subfloor **OR** installed over cleavage membrane, **as directed**; epoxy grout; TCA F132.
1) Tile Type: as directed by the Owner.
2) Grout: Water-cleanable epoxy grout.

l. Tile Installation F133: Chemical-resistant furan mortar **OR** Water-cleanable, tile-setting epoxy, **as directed**; furan grout. TCA F133 except use water-cleanable, tile-setting epoxy instead of chemical-resistant furan mortar for setting tile.
1) Tile Type: as directed by the Owner.
2) Grout: Chemical-resistant furan grout.

2. Interior Floor Installations, Wood Subfloor:

a. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

b. Tile Installation F141: Cement mortar bed (thickset) with cleavage membrane; TCA F141 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation F142: Organic adhesive; TCA F142.
   1) Tile Type: as directed by the Owner.
   2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

d. Tile Installation F143: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F143.
   1) Tile Type: as directed by the Owner.
   2) Grout: Water-cleanable epoxy grout.

e. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

f. Tile Installation F150/160: Thin-set mortar on exterior-glue plywood; TCA F150 or TCA F160.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar: EGP latex-portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

3. Interior Radiant Heat Floor Installations, Concrete Subfloor:
   a. Tile Installation RH110: Thin-set mortar on crack isolation membrane; hydronic piping installed in concrete; TCA RH110.
      1) Tile Type: as directed by the Owner.
      2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
      3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
   b. Tile Installation RH115: Thin-set mortar; electric radiant system encapsulated in thin-set mortar; TCA RH115.
      1) Tile Type: as directed by the Owner.
      2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.

3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation RH116: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH116.
1) Tile Type: as directed by the Owner.
2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

4. Interior Radiant Heat Floor Installations, Wood Subfloor:
a. Tile Installation RH130: Thin-set mortar on exterior-glue plywood; electric radiant system encapsulated in thin-set mortar; TCA RH130.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: EGP latex-portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

b. Tile Installation RH135: Thin-set mortar on cementitious backer units or fiber cement underlayment; electric radiant system encapsulated in thin-set mortar; TCA RH135.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation RH140: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH140.
1) Tile Type: as directed by the Owner.
2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

5. Interior Wall Installations, Masonry or Concrete:
a. Tile Installation W202: Thin-set mortar; TCA W202.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

b. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.

4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation W221: Cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

d. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

e. Tile Installation W223: Organic adhesive; TCA W223.
1) Tile Type: as directed by the Owner.
2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

6. Interior Wall Installations, Wood Studs or Furring:

a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
1) Tile Type: as directed by the Owner.

2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

d. Tile Installation W231: Cement mortar bed (thickset); TCA W231 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

e. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

f. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

g. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

7. Interior Wall Installations, Metal Studs or Furring:
a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
   1) Tile Type: as directed by the Owner.
   2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

d. Tile Installation W241: Cement mortar bed (thickset); TCA W241 and ANSI A108.1B.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

e. Tile Installation W242: Organic adhesive on gypsum board; TCA W242.
   1) Tile Type: as directed by the Owner.
   2) Grout: Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

f. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

g. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

h. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
   1) Tile Type: as directed by the Owner.
   2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
   3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

8. Bathtub Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
   a. Tile Installation B413: Thin-set mortar **OR** Organic adhesive, **as directed**, on water-resistant gypsum board; TCA B413.
      1) Tile Type: as directed by the Owner.
      2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
      3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

9. Bathtub/Shower Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
   a. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.
      1) Tile Type: as directed by the Owner.
      2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **s drected**, portland cement mortar.
      3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
   b. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.
      1) Tile Type: as directed by the Owner.

2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

c. Tile Installation B419: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant backer board; TCA B419.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.

10. Shower Receptor and Wall Installations, Concrete or Masonry:
a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

b. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Latex-portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

c. Tile Installation B422: Thin-set mortar on waterproof membrane with integrated bonding flange for bonded membranes; TCA B422.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

11. Shower Receptor and Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
1) Tile Type: as directed by the Owner.
2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

b. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

c. Tile Installation B420: Thin-set mortar on coated glass-mat, water-resistant backer board; TCA B420.
1) Tile Type: as directed by the Owner.

2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

d. Tile Installation B421: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment; TCA B421.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Latex-portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

e. Tile Installation B422: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment with integrated bonding flange for bonded membranes; TCA B422.
1) Tile Type: as directed by the Owner.
2) Thin-Set Mortar: Latex-portland cement mortar.
3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

END OF SECTION 09 01 30 91

SECTION 09 01 60 91 - PORTLAND CEMENT TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for portland cement terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Poured-in-place portland cement terrazzo flooring and base.
b. Poured-in-place rustic terrazzo flooring.
c. Precast terrazzo units.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement that indicates cost for each product having recycled content.
b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected
5. Qualification data.
6. Material certificates.
7. Maintenance data.

D. Quality Assurance
1. Installer Qualifications: An installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions
1. Environmental Limitations: Maintain temperature above 50 deg F (10 deg C) for 48 hours before and during terrazzo installation.
2. Weather Limitations: Proceed with rustic terrazzo installation only when forecasted weather conditions permit work to be performed according to NTMA's written recommendations and temperatures remain above 45 deg F (7.2 deg C).
3. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

4. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
   a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Portland Cement Terrazzo
   1. Portland Cement Terrazzo Type: Sand cushion **OR** Structural **OR** Bonded **OR** Monolithic **OR** Installed over metal deck, **as directed**.
   2. Materials:
      a. Portland Cement: ASTM C 150, Type 1.
         1) Color for Exposed Matrix: As required by mix indicated **OR** White **OR** Gray, **as directed**.
      b. Water: Potable.
      c. Sand: ASTM C 33.
      d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
         1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131 and ASTM C 535, **as directed**.
         2) 24-Hour Absorption Rate: Less than 0.75 percent.
         3) Dust Content: Less than 1.0 percent by weight.
      e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
      f. Bonding Agent: Neat portland cement or epoxy or acrylic bonding agents formulated for use with topping indicated.
      g. Underbed Reinforcement: Galvanized welded-wire reinforcement, 2 by 2 inches (51 by 51 mm) by 0.062-inch- (1.57-mm-) diameter wire, complying with ASTM A 1064 and ASTM A 82, except for minimum wire size.
      h. Isolation Membrane: Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick; or unperforated asphalt felt, ASTM D 226, Type I (No. 15).
   3. Mixes:
      a. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
      b. Underbed (for sand-cushion or bonded portland cement terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for component proportions and mixing.
      c. Portland Cement Terrazzo (below for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
         1) Formulated Mix Color and Pattern: As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA Venetian-terrazzo plates, **as directed**.
      d. Portland Cement Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
         1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.

B. Rustic Terrazzo
   1. Rustic Terrazzo Type: Structural **OR** Bonded **OR** Monolithic **OR** Unbonded, **as directed**.
   2. Materials:
      a. Portland Cement: ASTM C 150, Type 1.
         1) Color for Exposed Matrix: As required by mix indicated.
      b. Water: Potable.

c. Sand: ASTM C 33.
d. Marble Chips **OR** Aggregates, **as directed**: As required for mix indicated, sizes complying with NTMA gradation standards, 0.25 percent maximum 24-hour absorption rate, and containing no deleterious or foreign matter.
e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight and weather, and compatible with matrix binder.
f. Air-Entraining Agent (for underbed of structural, bonded, or unbonded rustic terrazzo): Complying with NTMA's written recommendations and recommended by supplier for intended use.
g. Underbed Bonding Agent (for bonded rustic terrazzo): Neat portland cement.
h. Topping Bonding Agent (for monolithic rustic terrazzo): Neat portland cement, or epoxy or acrylic bonding agents formulated for use with topping indicated.
i. Isolation Membrane (for unbonded rustic terrazzo): Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick.

3. Mixes:
a. Underbed (for structural or unbonded rustic terrazzo): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
b. Underbed (for bonded rustic terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for component proportions and mixing.
1) Exterior Applications: Provide air-entraining agent.
c. Rustic Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
1) Formulated Mix Color and Pattern: As selected from NTMA rustic-terrazzo plates.
d. Rustic Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.

C. Strip Materials
1. Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
a. Material: As indicated **OR** White-zinc alloy **OR** Brass, **as directed**.
b. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
c. Width: As indicated **OR** 0.05 inch (1.27 mm) **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
2. Heavy-Top Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
a. Base-Section Material: As indicated **OR** White-zinc alloy **OR** Galvanized steel, **as directed**.
b. Top-Section Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
c. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
d. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
3. Heavy-Top Angle Divider Strips: One-piece, L-type angle strips with anchoring device and in depth required for topping thickness indicated.
a. Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
b. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
4. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.

5. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Brass **OR** Plastic strips in color selected from manufacturer's full range, **as directed**, with removable zip-strip top for installing sealant; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
6. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
   a. Base-bead strips for exposed top edge of terrazzo base.
   b. Edge-bead strips for exposed edges of terrazzo.
   c. Nosings for terrazzo stair treads and landings.
7. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
   a. Width: 1/2 inch (12.7 mm).
   b. Depth: As required by terrazzo thickness.
   c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
   d. Color: As selected from manufacturer's full range.

D. Miscellaneous Accessories
1. Strip Adhesive: Adhesive recommended by manufacturer for this use.
   a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Anchoring Devices:
   a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
   b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
3. Isolation and Expansion-Joint Material: Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and nonoutgassing in unruptured state; butyl rubber; rubber; or cork; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
4. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.
5. Rustic Terrazzo Cleaner: Solution of muriatic acid and water for use on terrazzo type indicated.
6. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
   a. Rustic Terrazzo: Use solvent acrylic-type sealer.

E. Precast Terrazzo
1. Precast Terrazzo Base Units: Minimum 3/4-inch- (19-mm-) thick, reinforced portland cement terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm).
   a. Type: As indicated **OR** Coved with minimum 3/4-inch (19-mm) radius **OR** Straight **OR** Splayed, **as directed**.
   b. Top Edge: Straight, unfinished if top edge is concealed **OR** Beveled with polished top surface **OR** Radius edge with polished top surface, **as directed**.
   c. Metal Toe Strip (for coved-toe bases): Zinc **OR** Brass, **as directed**.
   d. Outside Corner Units: With finished returned edges at outside corner.
   e. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
2. Precast Terrazzo Units for Stair Treads, Thresholds, Sills**,** Benches and Planters: Comply with NTMA's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.
   a. Stair Treads: Three-line **OR** Two-line **OR** One-line **OR** Abrasive nosing strip and two-line, **as directed**, abrasive inserts at nosings.

b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.

3. Precast Terrazzo Finishing (for custom precast terrazzo components):
   a. Finish exposed-to-view edges or reveals to match face finish.
   b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates to produce clean, dry, and neutral substrate for terrazzo application.
   a. Remove substances, including oil, grease, and curing compounds, that might impair bond of terrazzo system.
   b. Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.
2. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
   a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

B. Installation, General

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
3. Structural Portland Cement **OR** Structural Rustic **OR** Bonded Rustic **OR** Monolithic Rustic **OR** Unbonded Rustic, **as directed**, Terrazzo: Install isolation and expansion material where terrazzo and underbed abut **OR** terrazzo abuts, **as directed**, adjacent construction and directly above substrate expansion joints.
4. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck, or for structural or unbonded rustic terrazzo): Install structural-concrete underbed according to requirements specified in Division 03 Section "Cast-in-place Concrete".
5. Underbed (for sand-cushion or bonded portland cement terrazzo or for bonded rustic terrazzo):
   a. Comply with NTMA's "Terrazzo Specifications and Design Guide" for underbed installation.
   b. For sand-cushion portland cement terrazzo only:
      1) Cover entire surface to receive terrazzo with dusting of sand.
      2) Install isolation membrane over sand, overlapping ends and edges a minimum of 3 inches (75 mm).
      3) Install welded wire reinforcement, overlapping at edges and ends at least two squares. Stop mesh a minimum of 1 inch (25 mm) short of expansion joints.
   c. Place underbed and screed to elevation indicated below finished floor elevation.
6. Strip Materials:
   a. Divider and Control-Joint Strips:
      1) Locate divider strips over each edge of steel beams and girders **OR** centered over steel beams and joists **OR** directly over control joints, breaks, and saw cuts in concrete slabs **OR** in locations indicated, **as directed**.
      2) Install control-joint strips back to back and directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
      3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
      4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
   b. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Form expansion joints using divider strips and install directly above concrete-slab expansion joints.

c. Accessory Strips: Install accessory strips as required to provide a complete installation.
d. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.

7. Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.

C. Portland Cement Terrazzo Installation
1. Pour in place, cure, and finish portland cement terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
2. Terrazzo Topping Thickness: As indicated.
3. Finishing:
a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.
b. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
c. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.

D. Rustic Terrazzo Installation
1. Pour in place, cure, and finish rustic terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
2. Terrazzo Topping Thickness: As indicated.
3. Finishing:
a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.

E. Precast Terrazzo Installation
1. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 inch (3.2 mm) maximum in length, height, or width; noncumulative.
3. Do not install units that are chipped, cracked, discolored, or improperly finished.
4. Seal joints between units with cement grout matching precast terrazzo matrix **OR** joint sealant, **as directed**.

F. Cleaning And Protection
1. Portland Cement Terrazzo and Precast Terrazzo Cleaning:
a. Remove grinding dust from installation and adjacent areas.
b. Wash surfaces with cleaner immediately after grouting precast terrazzo units and final cleaning of terrazzo flooring.
c. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
2. Rustic Terrazzo Cleaning: Clean surfaces with 1:10 solution of muriatic acid in water. Legally contain and dispose of runoff from cleaning operations. Rinse surfaces with water and allow to dry thoroughly.
3. Sealing:
a. Seal surfaces according to NTMA's written recommendations.
b. Apply sealer according to sealer manufacturer's written instructions.
4. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.

END OF SECTION 09 01 60 91

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SECTION 09 01 60 91a - CARPET

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Tufted carpet.
b. Woven carpet.
c. Carpet cushion.

C. Submittals
1. Product Data: For each product indicated.
2. Shop Drawings: Show the following:
a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
b. Existing flooring materials to be removed.
c. Existing flooring materials to remain.
d. Carpet type, color, and dye lot.
e. Locations where dye lot changes occur.
f. Seam locations, types, and methods.
g. Type of subfloor.
h. Type of installation.
i. Pattern type, repeat size, location, direction, and starting point.
j. Pile direction.
k. Type, color, and location of insets and borders.
l. Type, color, and location of edge, transition, and other accessory strips.
m. Transition details to other flooring materials.
n. Type of carpet cushion.
3. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
a. Carpet: 12-inch- (300-mm-) square Sample.
b. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
c. Carpet Cushion: 6-inch- (150-mm-) square Sample.
d. Carpet Seam: 6-inch (150-mm) Sample.
e. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.
4. LEED Submittals:
a. Product Data for Credit EQ 4.3:
1) For carpet, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
2) For carpet cushion, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label" program.
3) For installation adhesive, including printed statement of VOC content.
5. Product Schedule: For carpet and carpet cushion. Use same designations indicated on Drawings.
6. Maintenance data.

D. Quality Assurance
1. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
2. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 1.2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Comply with CRI 104, Section 5, "Storage and Handling."

F. Project Conditions
1. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
2. Environmental Limitations: Do not install carpet and carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
3. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
4. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

G. Warranty
1. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
   a. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
   c. Warranty Period: 10 years from date of Final Completion.
2. Special Warranty for Carpet Cushion: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.
   a. Warranty includes consequent removal and replacement of carpet and accessories.
   b. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
   c. Failure includes, but is not limited to, permanent indentation or compression.
   d. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

A. Tufted Carpet
1. Fiber Content: 100 percent nylon 6, 6 **OR** 100 percent nylon 6 **OR** 100 percent polypropylene, **as directed**.
2. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop **OR** Multilevel-loop **OR** Level tip shear **OR** Random shear **OR** Frieze **OR** Sculptured, **as directed**, pile.
3. Yarn Twist: as directed by the Owner.
4. Yarn Count: as directed by the Owner.
5. Density: as directed by the Owner.
6. Pile Thickness: finished carpet per ASTM D 6859.
7. Stitches: as directed by the Owner.
8. Gage: as directed by the Owner.
9. Face Weight: as directed by the Owner.

10. Total Weight: for finished carpet.
11. Primary Backing: Manufacturer's standard material **OR** Woven polypropylene **OR** Nonwoven, polypropylene or polyester, **as directed**.
12. Secondary Backing: Manufacturer's standard material **OR** Woven polypropylene **OR** Nonwoven, polypropylene or polyester **OR** Woven jute **OR** Fiberglass, **as directed**.
13. Backcoating: Manufacturer's standard material **OR** SBR latex **OR** PVC **OR** Thermoplastic copolymer, **as directed**.
14. Width: 12 feet (3.7 m) **OR** 6 feet (1.8 m) **OR** 13.5 feet (4.1 m) **OR** 15 feet (4.6 m), **as directed**.
15. Applied Soil-Resistance Treatment: Manufacturer's standard material.
16. Antimicrobial Treatment: Manufacturer's standard material.
17. Performance Characteristics: As follows:
    a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
    b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
    c. Tuft Bind: Not less than 3 lbf (13 N) **OR** 5 lbf (22 N) **OR** 6.2 lbf (28 N) **OR** 8 lbf (36 N) **OR** 10 lbf (45 N), **as directed**, per ASTM D 1335.
    d. Delamination: Not less than 2.5 lbf/in. (12 N/mm) **OR** 3.5 lbf/in. (15 N/mm) **OR** 4 lbf/in. (18 N/mm), **as directed**, per ASTM D 3936.
    e. Resistance to Insects: Comply with AATCC 24.
    f. Noise Reduction Coefficient (NRC): per ASTM C 423.
    g. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
    h. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
    i. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
    j. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
    k. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

B. Woven Carpet
1. Fiber Content: 100 percent wool **OR** 80 percent wool; 20 percent nylon 6, 6 **OR** 80 percent wool; 20 percent nylon 6, **as directed**.
2. Face Construction: Axminster **OR** Wilton **OR** Velvet, **as directed**.
3. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop, **as directed**, pile.
4. Yarn Twist: as directed by the Owner.
5. Yarn Count: as directed by the Owner.
6. Density: as directed by the Owner.
7. Pile Thickness: for finished carpet per ASTM D 6859.
8. Rows: as directed by the Owner.
9. Pitch: as directed by the Owner.
10. Face Weight: as directed by the Owner.
11. Total Weight: as directed by the Owner., for finished carpet.
12. Backing: Manufacturers standard **OR** As follows, **as directed**:
    a. Chain Warp: as directed by the Owner.
    b. Stuffer Warp: as directed by the Owner.
    c. Shot or Fill Weft: as directed by the Owner.
    d. Backcoating: as directed by the Owner.
13. Applied Soil-Resistance Treatment: Manufacturer's standard material.
14. Performance Characteristics: As follows:
    a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
    b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
    c. Resistance to Insects: Comply with AATCC 24.
    d. Noise Reduction Coefficient (NRC): per ASTM C 423.
    e. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.

f. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
g. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
h. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

C. Carpet Cushion
1. Traffic Classification: CCC Class I, moderate **OR** II, heavy **OR** III, extra-heavy, **as directed**, traffic.
2. Fiber Cushion: Rubberized hair, mothproofed and sterilized **OR** Rubberized jute, mothproofed and sterilized **OR** Synthetic **OR** Resinated, recycled textile, **as directed**.
   a. Weight: as directed by the Owner.
   b. Thickness: as directed by the Owner.plus 5 percent maximum.
   c. Density: as directed by the Owner.
3. Rubber Cushion: Flat **OR** Rippled waffle **OR** Textured flat **OR** Reinforced, **as directed**.
   a. Weight: as directed by the Owner.
   b. Thickness: as directed by the Owner.plus 5 percent maximum.
   c. Compression Resistance: at 25 **OR** 65, **as directed**, percent per ASTM D 3676.
   d. Density: as directed by the Owner.
4. Polyurethane-Foam Cushion: Grafted prime **OR** Densified **OR** Bonded **OR** Mechanically frothed, **as directed**.
   a. Compression Force Deflection at 65 Percent: per ASTM D 3574.
   b. Thickness: as directed by the Owner.
   c. Density: as directed by the Owner.
5. Performance Characteristics: As follows:
   a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
   b. Noise Reduction Coefficient (NRC): per ASTM C 423.
   c. Environmental Requirements: Provide carpet cushion that complies with testing and product requirements of Carpet and Rug Institute's "Green Label" program.

D. Installation Accessories
1. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet **OR** carpet cushion, **as directed**, manufacturer.
2. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer **OR** carpet and carpet cushion manufacturers, **as directed**.
   a. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
3. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.
4. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
5. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

1.3 EXECUTION

A. Preparation
1. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
3. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet **OR** carpet cushion, **as directed**, manufacturer.
4. Broom and vacuum clean substrates to be covered immediately before installing carpet.

B. Installation
1. Comply with CRI 104 and carpet manufacturer's **OR** carpet and carpet cushion manufacturers', **as directed**, written installation instructions for the following:
   a. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
   b. Double-Glue-Down Installation: Comply with CRI 104, Section 10, "Double Glue-Down Installation."
   c. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 11, "Attached-Cushion Installations."
   d. Preapplied Adhesive Installation: Comply with CRI 104, Section 11.4, "Pre-Applied Adhesive Systems (Peel and Stick)."
   e. Hook-and-Loop Installation: Comply with CRI 104, Section 11.5, "Hook and Loop Technology."
   f. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installation."
   g. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for stretch-in **OR** glue-down, **as directed**, installation.
2. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
   a. Bevel adjoining border edges at seams with hand shears **OR** Level adjoining border edges, **as directed**.
3. Do not bridge building expansion joints with carpet.
4. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
5. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
7. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.
8. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

C. Cleaning And Protecting
1. Perform the following operations immediately after installing carpet:
   a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   b. Remove yarns that protrude from carpet surface.
   c. Vacuum carpet using commercial machine with face-beater element.
2. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
3. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer **OR** and carpet adhesive manufacturer **OR** and carpet cushion and adhesive manufacturers, **as directed**.

END OF SECTION 09 01 60 91a

Task	Specification	Specification Description
09 01 60 91	01 22 16 00	No Specification Required
09 01 60 91	07 91 23 00	Joint Sealants
09 01 60 91	09 68 13 00	Carpet Tile
09 01 90 52	03 01 30 71	Concrete Rehabilitation
09 05 71 00	09 01 30 91	Ceramic Tile

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SECTION 09 22 13 13 - GYPSUM PLASTER

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Gypsum plasterwork on expanded-metal lath, unit masonry and monolithic concrete.
b. Solid-plaster partitions.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement indicating costs for each product having recycled content.
b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

D. Quality Assurance
1. Fire-Resistance Ratings: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound Transmission Characteristics: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

E. Delivery, Storage, And Handling
1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions
1. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.
2. Room Temperatures: Maintain temperatures at not less than 55 deg F (13 deg C) or greater than 80 deg F (27 deg C) for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.
3. Avoid conditions that result in gypsum plaster drying out too quickly.
a. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
b. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

1.2 PRODUCTS

A. Steel Framing For Solid-Plaster Partitions
1. Components, General: Comply with ASTM C 841. For steel sheet components not included in ASTM C 841, comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Channel Studs: Cold-rolled channels, 3/4 inch (19.1 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**, deep.
3. Runners: L-runners with perforated or plain legs to suit lath attachment requirements, in 0.033-inch (0.84-mm) base-metal thickness where attached to overhead support and in 0.043-inch (1.1-mm) base-metal thickness where attached to floor.

B. Expanded-Metal Lath
1. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coated.
a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
b. Paper Backing: Kraft paper factory bonded to back of lath.
c. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
d. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
e. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.

C. Accessories
1. General: Comply with ASTM C 841 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
a. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
b. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
c. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
2) Small nose cornerbead with perforated flanges; use on curved corners.
3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
d. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
e. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
f. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
g. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.
3. Plastic Accessories: Fabricated from high-impact PVC.
a. Cornerbeads: With perforated flanges.
1) Small nose cornerbead; use unless otherwise indicated.
2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.

b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
   1) Square-edge style; use unless otherwise indicated.
   2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25.4-mm-) **OR** 1-1/2-inch- (38.1-mm-), **as directed**, wide reveal; with perforated concealed flanges.

4. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.
   a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   b. Finish: Mill **OR** Chemical-conversion coating, ASTM D 1730, Type B, compatible with field-applied finish coatings specified, **as directed**.

D. Miscellaneous Materials
1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
2. Bonding Compound: ASTM C 631.
3. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
4. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 841.
5. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of rated assembly.
   b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
7. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
   a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Base-Coat Plaster Materials
1. Base-Coat Plasters, General: ASTM C 28/C 28M.
2. Lightweight Gypsum Ready-Mixed Plaster: With mill-mixed perlite aggregate.
3. Gypsum Neat Plaster: For use with job-mixed aggregates.
4. Gypsum Wood-Fibered Plaster:
5. High-Strength Gypsum Neat Plaster: With a minimum, average, dry compressive strength of 2800 psi (19 MPa) per ASTM C 472 for a mix of 100 lb (45 kg) of plaster and 2 cu. ft. (0.06 cu. m) of sand.
6. Aggregates for Base-Coat Plasters: ASTM C 35, sand and perlite.

F. Finish-Coat Plaster Materials
1. Gypsum Gaging Plaster: ASTM C 28/C 28M.
2. Gypsum Ready-Mixed Finish Plaster: Manufacturer's standard, mill-mixed, gaged, interior finish.
3. High-Strength Gypsum Gaging Plaster: ASTM C 28/C 28M, with a minimum, average, dry compressive strength of 5000 psi (34 MPa) per ASTM C 472 for a neat mix.
4. Gypsum Keene's Cement: ASTM C 61/C 61M.
5. Lime: ASTM C 206, Type S, special finishing hydrated lime.

6. Lime: ASTM C 206, Type N, normal finishing hydrated lime.
7. Aggregates for Float Finishes: ASTM C 35, sand **OR** perlite, **as directed**; graded per ASTM C 842.

G. Plaster Mixes
1. Mixing: Comply with ASTM C 842 and manufacturer's written instructions for applications indicated.

1.3 EXECUTION

A. Examination
1. Examine nonstructural and structural metal framing, substrates, and hollow-metal frames, for compliance with requirements and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

C. Installation, General
1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. STC-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
   a. Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
   b. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
3. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
4. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Steel Framing For Solid-Plaster Partitions
1. Install according to ASTM C 841.
2. Framing for Solid-Plaster Partitions: Provide channel stud to support expanded-metal lath construction.
   a. Space channel studs at 16 inches (406 mm) **OR** 24 inches (610 mm), **as directed**, o.c. unless otherwise indicated.
3. Framing for Studless Solid-Plaster Partition: Provide top and bottom L-track runners to support expanded-metal lath.

E. Installing Expanded-Metal Lath
1. Expanded-Metal Lath: Install according to ASTM C 841.
   a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
   b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
   c. Curved-Ceiling Framing: Install flat diamond-mesh lath.
   d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.
   e. Solid-Plaster Partitions: Where supported by channel studs, install flat rib **OR** flat diamond-mesh, **as directed**, lath.

f. Studless Solid-Plaster Partitions: Install 3/8-inch (9.5-mm) rib lath.

F. Installing Accessories
1. General: Install according to ASTM C 841.
2. Cornerbeads: Install at external corners.
3. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.
4. Control Joints: Install control joints at locations indicated on Drawings **OR** with spacing between joints in either direction not exceeding the following and in specific locations approved by Architect for visual effect, **as directed**:
   a. Partitions: 30 feet (9 m).
   b. Ceilings: 50 feet (15 m) **OR** 30 feet (9 m), **as directed**.

G. Plaster Application
1. General: Comply with ASTM C 842.
   a. Do not deviate more than plus or minus 1/8 inch in 10 feet (3.1 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
   b. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
   c. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   d. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Base Coats:
   a. Base Coats over Expanded-Metal Lath: High-strength gypsum **OR** Gypsum neat, **as directed**, plaster with job-mixed sand for scratch and brown coats.
   b. Base Coats over Expanded-Metal Lath:
      1) Scratch Coat: Gypsum wood-fibered plaster; neat or with job-mixed sand.
      2) Brown Coat: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster **OR** neat plaster with job-mixed perlite, **as directed**.
   c. Base Coats over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster, **as directed**.
   d. Base-Coat Mix over Monolithic Concrete: Gypsum neat plaster with job-mixed sand.
4. Finish Coats:
   a. Finish-Coat Mix for Smooth-Troweled Finishes: Gypsum gaging plaster **OR** Gypsum ready-mixed finish plaster **OR** High-strength gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
   b. Finish-Coat Mix for Float Finishes: Gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
   c. Finish-Coat Mix for Sprayed Finishes: Gypsum ready-mixed finish plaster.
   d. Finish-Coat Mix for Textured Finishes: Gypsum ready-mixed finish plaster.
5. Plaster Finishes:
   a. Provide troweled finish unless otherwise indicated **OR** where indicated, **as directed**.
   b. Provide float finish unless otherwise indicated **OR** where indicated, **as directed**.
   c. Provide sprayed finish unless otherwise indicated **OR** where indicated, **as directed**.
      1) Sprayed Finish: Match sample.
   d. Provide textured finish where indicated.
      1) Textured Finish: Match sample.
6. Concealed Plaster:

a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, finish coat may be omitted.

H. Plaster Repairs
1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

I. Cleaning And Protection
1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 13

SECTION 09 22 13 13a - GYPSUM VENEER PLASTER

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Gypsum veneer plaster and gypsum base for veneer plaster.
b. Gypsum veneer plaster over cementitious backer units.
c. Gypsum veneer plaster over masonry surfaces.
d. Gypsum veneer plaster over monolithic concrete surfaces.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations, fabrication, and installation of control joints, and reveals and trim; include plans, elevations, sections, details of components, and attachments to other work.
3. Samples: For the following products:
a. Trim Accessories: Full-size Sample in 12-inch (300-mm) length for each trim accessory.
b. Textured Finishes: Manufacturer's standard size for each textured finish and on rigid backing.
4. LEED Submittals:
a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
b. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance
1. Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, **OR** cementitious base units, **as directed**, joint reinforcing tape, and embedding material, from a single manufacturer.
2. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a testing and inspecting agency.
3. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

E. Delivery, Storage, And Handling
1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions
1. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.

2. Room Temperatures: Maintain not less than 55 deg F (13 deg C) or more than 80 deg F (27 deg C) for 7 days before application of gypsum base and gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
3. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
   a. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
   b. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
   c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
4. Do not install panels that are wet, moisture damaged, or mold damaged.
   a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
   b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.2 PRODUCTS

A. Gypsum Veneer Plaster Materials
1. One-Component Gypsum Veneer Plaster: ASTM C 587, formulated for application directly over substrate without use of separate base-coat material.
2. High-Strength, One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472; and formulated for application directly over substrate without use of separate base-coat material.
3. Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat and one for finish-coat application over substrates.
4. High-Strength, Two-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, base-coat plaster and smooth finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472.
5. Radiant-Heat, Two-Component Gypsum Veneer Plaster: ASTM C 587, and approved in writing by gypsum veneer plaster manufacturer for application with embedded electric heating cables.
   a. Provide ready-mixed **OR** job-aggregated, **as directed**, components, as standard for manufacturer, to comply with manufacturer's written recommendations.
   b. Aggregate: For job-aggregated base coat and texture finish coat, provide white silica sand passing a No. 30 (0.6-mm) sieve.

B. Panel Products
1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
3. Gypsum Base for Veneer Plaster: ASTM C 588/C 588M.
   a. Regular Type: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
   b. Type X: In thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
   c. Foil-Backed, Regular-Type Core: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
   d. Type C: In thickness indicated **OR** 5/8 inch (16 mm) thick **OR** 1/2 inch (13 mm) thick, **as directed**.
   e. Abuse-Resistant Base: With specially reinforced core for greater resistance to surface indentation, 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.

f. High-Impact Base: With Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance), and in thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
   1) Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.

g. Moisture- and Mold-Resistant Base: With moisture- and mold-resistant core, glass-mat facing on both sides of panel, and in thickness indicated **OR** 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.
   1) Mold Resistance: ASTM D 3273; no mold growth after four weeks' exposure.

4. Backing Panels for Multilayer Applications: ASTM C 588/C 588M gypsum base or ASTM C 36/C 36M gypsum board, as recommended by gypsum veneer plaster manufacturer, for application method and thicknesses indicated.
   a. Core: Matching face layer, unless otherwise indicated.
   b. Thickness: Matching face layer, unless otherwise indicated.
5. Cementitious Backer Units: ANSI A118.9, in thickness indicated **OR** 1/2 inch (13 mm) thick, **as directed**.

C. Trim Accessories
1. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
   a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
   b. Shapes:
      1) Cornerbead.
      2) Bullnose bead.
      3) LC-Bead: J-shaped; exposed long flange receives joint compound.
      4) L-Bead: L-shaped; exposed long flange receives joint compound.
      5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
      6) Curved-Edge Cornerbead: With notched or flexible flanges.
      7) Control joints.
2. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   b. Finish: Manufacturer's standard Architectural Class II, Clear Anodic Finish AA-M12C22A31, complying with AAMA 611 **OR** chemical conversion coat finish **OR** prime paint finish, **as directed**.

D. Joint Reinforcing Materials
1. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
2. Joint Tape:
   a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for applications indicated **OR** Paper **OR** Open-mesh, glass fiber, **as directed**.
   b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
3. Embedding Material for Joint Tape:
   a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.
   b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer for applications indicated.

E. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

2. Bonding Agent: ASTM C 631, polyvinyl acetate.
3. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum base face-layer panels to backing-layer panels in multilayer construction.
   a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
5. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
7. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
   a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Patching Mortar: Dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

F. Gypsum Veneer Plaster Mixes
1. Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

1.3 EXECUTION

A. Preparation
1. Monolithic Concrete Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
   a. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
   b. Remove ridges and protrusions greater than 1/8 inch (3 mm) and fill depressions greater than 1/4 inch (6 mm) with patching mortar. Allow to set and dry.
   c. Apply bonding agent on dry and cured concrete substrates.
2. Masonry Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
   a. Clean surfaces to remove dirt, grease, oil, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
   b. Apply bonding agent on dry masonry substrates.

B. Installing Panels, General
1. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.
   a. Do not allow gypsum base to degrade from exposure to sunlight as evidenced by fading of paper facing.
   b. Erection Tolerance: No more than 1/16-inch (1.6-mm) offsets between planes of gypsum base panels, and 1/8 inch in 8 feet (3 mm in 2.4 m) noncumulative, for level, plumb, warp, and bow.

2. Install sound attenuation blankets before installing gypsum base for veneer plaster unless blankets are readily installed after panels have been installed on one side.
3. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
4. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.6 mm) of open space between panels. Do not force into place.
5. Locate edge and end joints over supports except in ceiling applications where intermediate supports or back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints, other than control joints, at corners of framed openings.
6. Attach panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
7. Attach panels to framing provided at openings and cutouts.
8. Form control joints with space between edges of adjoining panels.
9. Cover both sides of steel stud partition framing with panels in concealed spaces, including above ceilings, except in internally braced chases.
    a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.74 sq. m) in area.
    b. Fit panels around ducts, pipes, and conduits.
    c. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints; seal joints with acoustical sealant.
10. Wood Framing: Install panels over wood framing, with "floating" internal corner construction. Do not attach panels across the flat grain of wide-dimension lumber, including floor joists and headers. "Float" panels over these members or provide control joints to counteract wood shrinkage.
11. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
12. Fastener Spacing: Comply with ASTM C 844, manufacturer's written recommendations, and fire-resistance-rating requirements.
    a. Space screws a maximum of 12 inches (305 mm) o.c. along framing members for wall or ceiling application.
    b. Space fasteners in cementitious backer units a maximum of 8 inches (200 mm) o.c. along framing members for wall applications and 6 inches (150 mm) o.c. along framing members for ceiling applications.

C. Installing Panels
1. Install gypsum base panels for veneer plaster in the following locations:
    a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
    b. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
    c. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
    d. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
    e. Foil-Backed, Regular-Type Core: As indicated on Drawings **OR as directed**.
    f. Abuse-Resistant Base: As indicated on Drawings **OR as directed**.
    g. High-Impact Base: As indicated on Drawings **OR as directed**.
    h. Moisture- and Mold-Resistant Base: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:

a. On ceilings, apply gypsum base panels before wall panels, to the greatest extent possible and at right angles to framing, unless otherwise indicated.
b. On walls, apply gypsum base panels vertically and parallel **OR** horizontally and perpendicular, **as directed**, to framing, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
   2) At stairwells and other walls higher than 30 feet (9.0 m), install gypsum base panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
c. On Z-furring, apply gypsum base panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

3. Multilayer Application on Ceilings: Apply backing panels for ceilings before applying backing panels for partitions; apply gypsum-base face layers in same sequence. Apply backing panels at right angles to framing members and offset gypsum-base face-layer joints a minimum of 16 inches (400 mm) from parallel backing panel joints, unless otherwise required by fire-resistance-rated assembly.
4. Multilayer Application on Partitions: Apply backing panels indicated and gypsum-base face layers vertically (parallel to framing) with joints of backing panels located over stud or furring members and gypsum-base face-layer joints offset at least one stud or furring member from backing-panel joints, unless otherwise required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   a. Z-Furring: Apply backing panels vertically (parallel to framing) and gypsum-base face layer either vertically or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of backing panels over furring members.
5. Single-Layer Fastening Methods: Apply gypsum base panels to supports with steel drill screws.
6. Multilayer Fastening Methods: Fasten backing panels and gypsum-base face layers separately to supports with screws **OR** with screws; fasten gypsum-base face layers with adhesive and supplementary fasteners, **as directed**.
7. Curved Partitions: Comply with gypsum base manufacturer's written installation recommendations.
8. Cementitious Backer Units: Install according to ANSI A108.11.
   a. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

D. Installing Trim Accessories
1. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
2. Control Joints: Install at locations indicated on Drawings **OR** according to ASTM C 844 and in specific locations approved by the Owner, **as directed**.
3. Trim: Install in the following locations:
   a. Cornerbead: Use at outside corners, unless otherwise indicated.
   b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
   c. LC-Bead: Use at exposed panel edges.
   d. L-Bead: Use where indicated.
   e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
   f. Curved-Edge Cornerbead: Use at curved openings.
4. Aluminum Trim:
   a. Install aluminum trim according to manufacturer's written recommendations.
   b. Apply and embed joint tape over flanges of aluminum trim accessories if recommended by trim manufacturer.

E. Installing Joint Reinforcement

1. Gypsum Base for Veneer Plaster: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.
2. Abuse-Resistant Base: Reinforce joints between abuse-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
3. Impact-Resistant Base: Reinforce joints between impact-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
4. Moisture- and Mold-Resistant Base: Reinforce joints between moisture- and mold-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
5. Cementitious Backer Units: Reinforce joints between cementitious backer units with joint tape and embedding material according to unit manufacturer's written recommendations.

F. Gypsum Veneer Plastering
1. Bonding Agent: Apply bonding agent on dry monolithic concrete **OR** masonry **OR** abuse-resistant base panels **OR** cementitious backer units, **as directed**, according to gypsum veneer plaster manufacturer's written recommendations.
2. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.
   a. One-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections. Allow plaster to set, then scratch and immediately double back with gypsum veneer plaster to uniform total thickness of 3/16 inch (4.8 mm).
   b. Two-Component Gypsum Veneer Plaster:
      1) Base Coat: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections.
      2) Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
   c. Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.
   d. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations and as approved by the Owner.
3. Radiant-Heat, Two-Component Gypsum Veneer Plaster Ceilings: Comply with ASTM C 843 and with radiant-heat veneer plaster manufacturer's written recommendations.
   a. Base Coat: Apply plaster base coat to sufficiently cover electric heating cables. Trowel plaster parallel in direction of cables to uniform thickness of 3/16 inch (4.8 mm). Completely cover cables.
   b. Finish Coat: After base coat has developed sufficient bond, apply finish coat. Trowel plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
4. Concealed Surfaces: Do not omit gypsum veneer plaster behind cabinets, furniture, furnishings, and similar removable items. Omit veneer plaster in the following areas where it will be concealed from view in the completed Work unless otherwise indicated or required to maintain fire-resistance and STC ratings:
   a. Above suspended ceilings.
   b. Behind wood paneling.
5. Gypsum Veneer Plaster Finish: Smooth-troweled finish, unless otherwise indicated **OR** Textured finish matching the Owner's sample, **as directed**.

G. Protection
1. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.
2. Remove and replace gypsum veneer plaster and gypsum base panels that are wet, moisture damaged, or mold damaged.

a. Indications that gypsum base panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
b. Indications that gypsum base panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 22 13 13a

SECTION 09 22 13 13b - PORTLAND CEMENT PLASTER

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Interior portland cement plasterwork on metal lath, unit masonry and monolithic concrete.
b. Exterior portland cement plasterwork (stucco) on metal lath, unit masonry and monolithic concrete.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement indicating costs for each product having recycled content.
b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
4. Samples: For each type of factory-prepared, colored or textured finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

D. Quality Assurance
1. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions
1. Comply with ASTM C 926 requirements.
2. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.
a. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
b. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.
3. Exterior Plasterwork:

a. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
b. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
c. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

4. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.2 PRODUCTS

A. Metal Lath
1. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
b. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
c. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
d. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.
2. Wire-Fabric Lath:
a. Welded-Wire Lath: ASTM C 933; self-furring, 1.4 lb/sq. yd. (0.8 kg/sq. m) **OR** 1.95 lb/sq. yd. (1.1 kg/sq. m), **as directed**.
b. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing, 1.1 lb/sq. yd. (0.6 kg/sq. m) **OR** 1.4 lb/sq. yd. (0.8 kg/sq. m), **as directed**.
3. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper **OR** Grade B, Style 1a vapor-retardant paper, **as directed**.
a. Provide paper-backed lath unless otherwise indicated **OR** at exterior locations **OR** in locations indicated on Drawings, **as directed**.

B. Accessories
1. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
a. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
c. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
d. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
2) Small nose cornerbead with perforated flanges; use on curved corners.
3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
e. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.

f. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
g. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
h. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.

3. Plastic Accessories: Fabricated from high-impact PVC.
   a. Cornerbeads: With perforated flanges.
      1) Small nose cornerbead; use unless otherwise indicated.
      2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
   b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
      1) Square-edge style; use unless otherwise indicated.
      2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
   c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
   d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25-mm-) **OR** 1-1/2-inch- (38-mm-), **as directed**, wide reveal; with perforated concealed flanges.

C. Miscellaneous Materials
1. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
2. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.
3. Bonding Compound: ASTM C 932.
4. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
5. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
6. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
7. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
8. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants".
   a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Plaster Materials
1. Portland Cement: ASTM C 150, Type I **OR** Type II, **as directed**.
   a. Color for Finish Coats: White **OR** Gray, **as directed**.
2. Masonry Cement: ASTM C 91, Type N.
   a. Color for Finish Coats: White **OR** Gray, **as directed**.
3. Plastic Cement: ASTM C 1328.
4. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match sample.

5. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
6. Sand Aggregate: ASTM C 897.
   a. Color for Job-Mixed Finish Coats: White **OR** In color matching sample, **as directed**.
7. Perlite Aggregate: ASTM C 35.
8. Exposed Aggregates for Finish Coats: For marblecrete finish, clean, sound, crushed marble matching color and size gradation of sample.
9. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
   a. Color: As selected from manufacturer's full range.
10. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
    a. Color: As selected from manufacturer's full range.

E. Plaster Mixes
1. General: Comply with ASTM C 926 for applications indicated.
   a. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
2. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
   a. Portland Cement Mixes:
      1) Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      2) Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
   b. Masonry Cement Mixes:
      1) Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
      2) Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
   c. Portland and Masonry Cement Mixes:
      1) Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      2) Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
   d. Plastic Cement Mixes:
      1) Scratch Coat: 1 part plastic cement and 2-1/2 to 4 parts aggregate.
      2) Brown Coat: 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
   e. Portland and Plastic Cement Mixes:
      1) Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      2) Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
3. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
   a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   b. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

4. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
   a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   b. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
   c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.
5. Job-Mixed Finish-Coat Mixes:
   a. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 **OR** 1-1/2 to 2, **as directed**, parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
   b. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
   c. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
   d. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.
6. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters or acrylic-based finish coatings, comply with manufacturer's written instructions.

1.3 EXECUTION

A. Examination
1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
2. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

C. Installation, General
1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
3. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Metal Lath
1. Expanded-Metal Lath: Install according to ASTM C 1063.
   a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib **OR** welded-wire **OR** woven-wire, **as directed**, lath.
   b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib **OR** 3/8-inch (9.5-mm) rib lath **OR** welded-wire **OR** woven-wire, **as directed**, lath.
   c. Curved-Ceiling Framing: Install flat diamond-mesh **OR** welded-wire **OR** flat woven-wire, **as directed**, lath.
   d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh **OR** welded-wire **OR** woven-wire, **as directed**, lath.

E. Installing Accessories
1. Install according to ASTM C 1063 and at locations indicated on Drawings.
2. Reinforcement for External Corners:
   a. Install lath-type, external-corner reinforcement at exterior locations.
   b. Install cornerbead at interior and exterior, **as directed**, locations.

3. Control Joints: Install control joints at locations indicated on Drawings **OR** in specific locations approved for visual effect as follows, **as directed**:
   a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
      1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
      2) Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
   b. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
   c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
   d. Where control joints occur in surface of construction directly behind plaster.
   e. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

F. Plaster Application
1. General: Comply with ASTM C 926.
   a. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
   b. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   c. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork, on masonry or on concrete; 3/4-inch (19-mm) thickness.
   a. Portland cement mixes.
   b. Masonry cement mixes.
   c. Portland and masonry cement mixes.
   d. Plastic cement mixes.
   e. Portland and plastic cement mixes.
4. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 1/2 inch (13 mm) thick **OR** 3/4 inch (19 mm) thick on concrete, **as directed**.
   a. Portland cement mixes.
   b. Masonry cement mixes.
   c. Portland and masonry cement mixes.
   d. Plastic cement mixes.
   e. Portland and plastic cement mixes.
5. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch (10 mm) thick on concrete masonry **OR** 1/4 inch (6 mm) thick on concrete, **as directed**.
   a. Portland cement mixes.
   b. Masonry cement mixes.
   c. Portland and masonry cement mixes.
   d. Plastic cement mixes.
   e. Portland and plastic cement mixes.
6. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork, 1/4 inch (6 mm) thick on concrete.
   a. Portland cement mixes.
   b. Masonry cement mixes.
   c. Portland and masonry cement mixes.
   d. Plastic cement mixes.
   e. Portland and plastic cement mixes.
7. Plaster Finish Coats: Apply to provide float **OR** dash **OR** scraped trowel-textured **OR** skip trowel-textured **OR** brocade (knock-down dash) **OR** trowel sweep **OR** combed **OR** sacked (California mission) **OR** English **OR** marblecrete, **as directed**, finish to match sample.

8. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
9. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.
10. Concealed Interior Plasterwork:
    a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
    b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
    c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.

G. Plaster Repairs
1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

H. Protection
1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 13b

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Task	Specification	Specification Description
09 22 13 23	09 22 13 13	Gypsum Plaster
09 22 13 23	09 22 13 13a	Gypsum Veneer Plaster
09 22 13 23	09 22 13 13b	Portland Cement Plaster

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SECTION 09 22 16 13 - NON-LOAD-BEARING STEEL FRAMING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for non-load bearing steel framing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes non-load-bearing steel framing members for the following applications:
   a. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   b. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
   a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance
1. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.2 PRODUCTS

A. Non-Load-Bearing Steel Framing, General
1. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   a. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
   b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.

B. Suspension System Components
1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
2. Hanger Attachments to Concrete:
   a. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

1) Type: Cast-in-place anchor, designed for attachment to concrete forms **OR** Postinstalled, chemical anchor **OR** Postinstalled, expansion anchor, **as directed**.

b. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
4. Flat Hangers: Steel sheet, in size indicated on Drawings **OR** 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated, **as directed**.
5. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
   a. Depth: As indicated on Drawings **OR** 2-1/2 inches (64 mm) **OR** 2 inches (51 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Furring Channels (Furring Members):
   a. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
   b. Steel Studs: ASTM C 645.
      1) Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
      2) Depth: As indicated on Drawings **OR** 1-5/8 inches (41.3 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 3-5/8 inches (92.1 mm), **as directed**.
   c. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
      1) Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
   d. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
      1) Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
7. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

C. Steel Framing For Framed Assemblies
1. Steel Studs and Runners: ASTM C 645.
   a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
   b. Depth: As indicated on Drawings **OR** 3-5/8 inches (92.1 mm) **OR** 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 1-5/8 inches (41.3 mm), **as directed**.
2. Slip-Type Head Joints: Where indicated, provide one of the following:
   a. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   b. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   c. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
3. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
4. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.

5. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
   a. Depth: As indicated on Drawings **OR** 1-1/2 inches (38.1 mm), **as directed**.
   b. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
6. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   a. Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
   b. Depth: As indicated on Drawings **OR** 7/8 inch (22.2 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**.
7. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
   a. Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
8. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
   a. Depth: As indicated on Drawings **OR** 3/4 inch (19.1 mm), **as directed**.
   b. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
   c. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
9. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

D. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced installation standards.
   a. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
2. Isolation Strip at Exterior Walls: Provide one of the following:
   a. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   b. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

1.3 EXECUTION

A. Preparation
1. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   a. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
2. Coordination with Sprayed Fire-Resistive Materials:
   a. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
   b. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

B. Installation, General
1. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

a. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
b. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
c. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
d. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
3. Install bracing at terminations in assemblies.
4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

C. Installing Suspension Systems
1. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
3. Suspend hangers from building structure as follows:
a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
1) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
1) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
c. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
d. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
e. Do not attach hangers to steel roof deck.
f. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
g. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
h. Do not connect or suspend steel framing from ducts, pipes, or conduit.
4. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
5. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
6. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
7. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

D. Installing Framed Assemblies
1. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

2. Install studs so flanges within framing system point in same direction.
   a. Space studs as follows:
      1) Single-Layer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
      2) Multilayer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
      3) Tile backing panels: 16 inches (406 mm) **OR** 400 mm, **as directed**, o.c., unless otherwise indicated.
3. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   a. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   b. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      1) Install two studs at each jamb, unless otherwise indicated.
      2) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      3) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   c. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   d. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      1) Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   e. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   f. Curved Partitions:
      1) Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      2) Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
4. Direct Furring:
   a. Screw to wood framing.
   b. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
5. Z-Furring Members:
   a. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c.
   b. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
   c. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
6. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

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Task	Specification	Specification Description
09 22 36 13	09 22 13 13	Gypsum Plaster
09 22 36 13	09 22 13 13a	Gypsum Veneer Plaster
09 22 36 13	09 22 13 13b	Portland Cement Plaster

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SECTION 09 22 36 23 - LATH AND PLASTER RENOVATION

GENERAL

Description Of Work

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

Quality Assurance

2. Regulatory Requirements:
   a. Plaster Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
   b. Plaster Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire-protective ratings as indicated or scheduled.
   c. Fire Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Submittals

3. Product Data: Submit in accordance with Detailed Scope of Work. Include each type of plaster material, metal lath. and lathing accessories to be installed.

Delivery, Storage, And Handling

4. General:
   a. Plastering Materials: Deliver in original unopened containers and store off ground and under cover.
   b. Metal Lath and Accessories: Protect from rusting during storage.
   c. Rusted or Water Damaged Materials: Subject to rejection before or after installation.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
   a. Cold-Weather Protection: Do not apply plaster if ambient temperature is less than 4 degrees C (40 degrees F) or more than 26 degrees C (80 degrees F). Maintain this temperature range in all areas 7 days prior to application, during application, and for 7 days after plaster is set.
   b. Hot-Weather Protection: Protect plaster against uneven or excessive evaporation during dry, hot weather and from strong blasts of dry air, either natural or artificial.
   c. Ventilation: Ventilate building spaces as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.
6. Existing Conditions: See Division 1 Section “Summary of Work”. Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings, and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.
   a. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

PRODUCTS

Materials

9. Materials for Patching, Extending, and Matching:
   a. Provide same products or types of construction as existing structure, as needed to patch, extend, or match existing work.
      1) Generally, Contract Documents will not define products or standards of workmanship present in existing construction. Determine products by inspection and any necessary testing, and workmanship by use of existing as sample of comparison.
      2) Patching, extending, and matching of existing work and systems shall result in complete, finished system.
   b. Presence of product, finish, or type of construction, requires that patching, extending, or matching shall be performed as necessary to make work complete and consistent.
10. Partition Metals: ASTM C 645, galvanized steel:
   a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing, or as indicated.
      1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
   b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
   c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
   d. Sheet Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. Suspended Ceiling Metals:
   a. Main Runners (Primary Members): ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
      1) 50 mm (2 inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
      2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
      3) 19 mm (3/4 inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
   b. Cross Furring (Furring Channels): Hat-shaped galvanized steel furring channels, minimum 0.46 mm (25 gage).
   c. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
      1) Hanger Wire: Minimum 4.1 mm (8 gage).
      2) Tie Wire: 6 mm (16 gage).
12. Lath:
   a. Metal Lath: ASTM C 847, galvanized expanded metal.
      1) Weight: In compliance with ASTM C 841 for conditions and spacing of supports.
   b. Gypsum Lath: ASTM C 37, plain. Provide Type X at fire-rated assemblies.
      1) Thickness: As indicated or specified and in compliance with ASTM C 841 for conditions and spacing of supports.
13. Fasteners:
   a. Screws: ASTM C 1002, corrosion-resistant. Provide types as recommended by manufacturer for each application.
      1) To Metal Framing: Minimum 25 mm (1 inch), Type S.
      2) To Wood Framing: Minimum 32 mm (1-1/4 inch), Type W bugle head.
14. Accessories: ASTM C 841, galvanized steel.
   a. Comer Beads: Small nose with expanded flanges, unless otherwise indicated.
   b. Casing Beads: Square-edged style. with short or expanded flanges to suit kinds of plaster bases indicated.
   c. Control Joints: Prefabricated folded pair of non-perforated screeds in M-shaped configuration, with expanded or perforated flanges.
      1) Provide removable protective tape on plaster face of control joints.
   d. Cornerite: Galvanized expanded metal lath in accordance with ASTM C 841.
15. Gypsum Plaster Materials: ASTM C 28.
   a. Base Coat Plasters: One of following:
      1) Gypsum ready-mixed plaster with mill-mixed perlite aggregate.
      2) Gypsum wood-fibered plaster, ASTM C 28, Type N.
   b. Finish Coat Plasters: One of following:

1) Gypsum ready-mixed finished plaster, manufacturers standard mill-mixed gauged interior finish.
2) Gypsum Gauging Plaster: ASTM C 28, Type G.

c. Quicklime: ASTM C 5.
d. Sand: ASTM C 35.
e. Finishing Hydrated Limes: ASTM C 206, Type S, special hydrated lime for finishing purposes.
f. Bonding Compound for Gypsum Plaster: ASTM C 631.
g. Water: Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or substances that may be deleterious to plaster or metals in contact with plaster.

16. Sound-Isolation Materials:
    a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral-fiber blankets, 12 to 16 kg per cu m (0.75 to 1 PCF), thickness as indicated or scheduled, or required by fire-rated assembly.
    b. Acoustical Sealant:
        1) Concealed: ASTM C 919 nondrying, non-hardening, non-skinning, non-bleeding, and non-staining.
        2) Exposed: ASTM C 919 non-oxidizing and skinning, permanently elastic, and paintable.
    c. Ductwork Penetrations Packing: Low-density fiberglass.
17. Gypsum Plaster Mixes: As recommended by manufacturer:
    a. Scratch Coat:
        1) Over Metal Lath: Gypsum wood-fibered plaster, neat or with job-mixed sand.
        2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
        3) Over Unit Masonry: Gypsum wood-fibered plaster, neat or with job-mixed sand.
    b. Brown Coat:
        1) Over Metal Lath: Gypsum wood-fibered plaster, with job-mixed sand.
        2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
        3) Over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand.
    c. Finish Coat: Proportion materials for finish coats to comply with ASTM C 842 for each type of finish coat and texture indicated.
        1) Gypsum Gauging Plaster 1 part plaster and 2 parts lime.
            a) Over lightweight aggregate base coats, add 15 L (1/2 cubic foot) of perlite fines or 23 kg (50 pounds) of No. 1 white silica sand per 45 kg (100 pounds) of plaster.
        2) Gypsum Ready-mixed Finish Plaster Neat.
    d. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

EXECUTION

Examination

18. Units, Spaces, and Areas to be renovated: Comply with Detailed Scope of Work.
    a. Verify that surfaces to receive rough carpentry are prepared to required grades and dimensions.

Preparation

19. Dust Protection: Comply with Detailed Scope of Work.
20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
21. Protection: Comply with Detailed Scope of Work.
    a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during plastering operations.
22. Selective Demolition: Comply with Detailed Scope of Work.

23. Surface Preparation: Clean projections, dust, loose particles, grease, bond breakers, and foreign matter from surfaces to receive plaster.
    a. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or (2) that have been painted or previously plastered.
    b. Before plaster work is started, wet masonry and concrete surfaces thoroughly with fine fog spray of clean water to produce uniformly moist surface.
    c. Do not apply plaster to surfaces containing frost.

Laying-Out Work

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

Performance

26. Patching: Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship.
    a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
27. Damaged Surfaces: Comply with Detailed Scope of Work.
28. Transitions from Existing to New Work: Comply with Detailed Scope of Work.
29. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
    a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

30. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
31. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
32. Ceiling Suspension System Components: Install In sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
    a. Wire Hangers: Space and install wire hangers In accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
    b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
    c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
33. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

34. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
35. Steel Stud Systems: Comply with ASTM C 754.
    a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
36. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

37. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer’s recommendations.
38. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
39. Metal Furring Systems:
    a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.
40. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
    a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

41. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer’s recommendations and Reference Standards.
42. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
43. Ceiling Suspension System Components: Install In sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
    a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
    b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
    c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
44. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

45. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
46. Steel Stud Systems: Comply with ASTM C 754.
    a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
47. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

48. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.
49. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
50. Metal Furring Systems:
    a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.

Lathing

51. Metal Lathing: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
    a. At Metal Framing: Attach metal lath to furring channels with long dimension of sheet at right angles to furring channels with gage wire ties spaced not over 150 mm (6 inches) apart.
    b. At Wood Framing: Nail metal lath to wood framing with long dimension of sheet at right angles to framing member.
    c. Place ties where sides of sheets laps at supports and at side laps of sheets between supports. Lap metal lath not less than 13 mm (112 inch) at sides of sheets and 25 mm (1 inch) at ends of sheets.
    d. Suspended and Furred Ceilings: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
    e. Ceramic Tile Setting Beds: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
52. Gypsum Lath: Install in accordance with ASTM C 841.
    a. Wood Framing and Furrlng: Install lath as follows:
        1) With screws to comply with lath manufacturer's directions.
        2) With nails.
        3) Provide floating angle construction.
    b. Suspended and Furred Ceilings: Install lath to furring members with clips.
    c. Vertical Metal Framing and Furring: Install lath as follows:
        1) With screws.
        2) With clips, supplemented by screws where required by lath manufacturer.
        3) Where sound-rated partitions are indicated, attach lath with resilient clips.

Installation Of Accessories

53. Accessories: Install as required to repair area of work to match existing. Install in accordance with ASTM C 841. Miter or cope accessories at comers; Install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories In place and alignment during plastering.
54. Interior Corners: Apply cornerite.
55. Corner Beads: Install corner beads tightly secured to lath at exposed exterior corners.
56. Casing Beads: Install at terminations of plaster work, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or metal frames act as casing beads.
57. Control Joints: Install at locations indicated or, if not indicated, at spacings and locations required by Reference Standards. Coordinate specific locations with the Owner.
58. Access Panels: Provide access panels as required for maintenance of concealed plumbing work in coordination with Division 15 Section "Plumbing." Tiled Areas: Coordinate with Division 9 Section "Ceramic Tile."
59. Sound-Rated Plaster Work: Where sound-rated plaster work is indicated by STC ratings or other notation:
    a. Acoustical Sealant: Seal work at perimeters, control joints, openings, and penetrations with continuous bead of acoustical sealant. Comply with ASTM C 919 and plastering manufacturer's recommendations for location of sealant beads.

b. Sound Insulation: Install insulation blankets within stud cavities of sound-rated partition assemblies where incated.

Plastering

60. Plastering: Comply with ASTM C 842 in thickness to match existing.
    a. Preparation: Remove loose, fractured, or separated plaster to face of substrate. repairing lath at substrate to ensure repair area bounded by solid and sound existing plaster construction.
        1) Prepare monolithic surfaces for bonded base coats and use bonding compound to comply with Reference Standards for conditioning of monolithic surfaces.
    b. Grout hollow metal frames, bases, and similar work with base-mat plaster material, and prior to lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 150 mm (6 inches) at each jamb anchor dip.
    c. Plaster flush with metal frames and other built-in metal items or accessories that act as plaster ground, unless otherwise indicated. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at junctures with metal.
61. Preparation: Check metal grounds, comer beads, screeds, and other accessories carefully for alignment before starting plaster application. Check expansion and control joints and supporting metal structures to ensure that expansion and control joints can move unrestrained.
62. Plaster: Apply In accordance with ASTM C 842 in thickness to match existing:
    a. Use three-coat work over following plaster bases:
        1) Metal lath.
        2) Gypsum lath attached to ceiling supports by clips.
        3) Gypsum lath attached to ceiling supports spaced over 400 mm (16 inches) OC.
        4) Gypsum lath, 9.5 mm (3/8 inch) thick, with separate vapor retarder behind.
    b. Use two-coat work over following bases.
        1) Gypsum lath except for installations requiring three-coat work.
        2) Unit masonry.
        3) Concrete, cast-in-place or precast when surface condition complies with ASTM C 842 for plaster bonded to solid base.
    c. First Coat: Apply first coat of plaster with such force to secure good key.
    d. Finish Coats: Apply troweled finish coats unless otherwise indicated.
63. Workmanship: Perform work true to line, straight, and plumb.
    a. Finished Surfaces: Free from waves, dents, bumps, cracks, pits. checks, streaks, catfaces, blisters, or other defects. Cutout and property replace defective areas.
    b. Execute work to avoid any irregularity occurring at point or place where one section is joined to another.
    c. Arises and Angles: True and sharp.
64. Tolerances: Plaster surface plane within plus/minus 3 mm in 3 000 mm (1/8 inch in 10 feet).

Integrating Existing Work

65. Protection: Comply with Detailed Scope of Work.

Adjustments

66. Partition Removal: Comply with Detailed Scope of Work.

Dust Control

67. Dust: Comply with Detailed Scope of Work.

Patching And Cleaning

68. Cutting and Patching: Do necessary cutting, patching, and repairing and pointing up of plastering after other work is in place to restore defective areas. Repair or replace work to eliminate blisters, buckles, excessive crazing and check-cracking, dry outs, efflorescence, sweat-outs, and similar defects and where bond to substrate has failed.
    a. Sand smooth-troweled finishes lightly to remove trowel marks and arises.

69. Cleaning: As rapidly as plastering is completed in each space, clean up rubbish, utensils, and surplus material, sweep floor and leave in neat condition for work of others.
    a. When general plastering is concluded, remove plastering rubbish, equipment, and surplus materials from premises.
    b. Clean surfaces splattered with plaster.

END OF SECTION 09 22 36 23

Task	Specification	Specification Description
09 22 36 23	09 22 13 13	Gypsum Plaster
09 22 36 23	09 22 13 13a	Gypsum Veneer Plaster
09 22 36 23	09 22 13 13b	Portland Cement Plaster
09 22 36 33	09 22 13 13	Gypsum Plaster
09 22 36 33	09 22 13 13a	Gypsum Veneer Plaster
09 22 36 33	09 22 13 13b	Portland Cement Plaster
09 22 36 33	09 22 36 23	Lath and Plaster Renovation

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SECTION 09 23 13 00 - GYPSUM BOARD RENOVATION

GENERAL

Description Of Work

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

Submittals

2. Quality Assurance/Control Submittals
   a. Certificates: Manufacturer's written certification that gypsum products meet or exceed specified requirements.

Quality Assurance

3. Regulatory Requirements:
   a. Gypsum Board Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
   b. Gypsum Board Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire protective ratings as indicated or scheduled.
   c. Fire-Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Delivery, Storage, And Handling

4. Storage and Protection: Store wallboard off ground to protect it from weather and damage due to moisture damage.
   a. Wallboard: Dry, free of warpage, and have bundling tape intact immediatly prior to use.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
   a. During gypsum-panel application and finishing, maintain indoor temperatures within range of 13 degrees C (55 degrees F) to 21 degrees C (70 degrees F). Provide adequate ventilation to carry off excess moisture.
6. Existing Conditions: See Division 1 Section “Summary of Work”. Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.

PRODUCTS

Materials

9. Materials for Patching, Extending, and Matching:

a. Provide same products or types of construction as in existing structure, as needed to patch, extend, or match existing work.
   1) Generally, Contract Documents will not define products present in existing construction. Determine products by Inspection and any necessary testing.
   2) Patching, extending, and matching of existing work and systems shall result in a complete, finished system.
b. Presence of product, finish, or type of construction requires that patching, extending, or matching be performed as necessary to make work complete and consistent.

Metals

10. Partition Metals: ASTM C 645, galvanized steel:
    a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing or as indicated.
       1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
    b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
    c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
    d. Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission by resilient attachment of gypsum board, 13 mm (1/2 inch) deep.
    e. Sheet-Metal Reinforcement (Altemate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. Suspended Coiling Metals:
    a. Runner Channels: ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
       1) 50 mm (2 Inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
       2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
       3) 19 mm (3/4 Inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
    b. Furring Channels: Hat-shaped galvanized-steel furring channels, minimum 0.46 mm (25 gage).
    c. Steel Studs: Galvanized steel as specified above, minimum 0.46 mm (25 gage).
    d. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
       1) Hanger Wire: Minimum 4.1 mm (8 gage).
       2) Tie Wire: 6 mm (16 gage).

Gypsum Board And Related Materials

12. Gypsum Board: GA216 and ASTM C 36
    a. Size: 12.7 mm and 15.9 mm (1/2 inch and 5/8 inch) thick to match existing, as indicated or scheduled. Provide boards 1 200 mm (48 inches) wide by length required to minimize cross joints.
    b. Regular Tapered-edge gypsum panels.
       1) Provide Type X gypsum panels at fire-rated assemblies.
    c. Water-Resistant: ASTM C 630, paintable, tapered-edge gypsum panels.
       1) Provide Type X water-resistant gypsum panels at fire-rated assemblies.
13. Cementitious Backer Units (CBU): ANSI A118.9, nailable/screwable backer board composed of stable portland cement, aggregates, and reinforcements with ability to remain unaffected by prolonged exposure to moisture, 12.7 mm (112 inch) thick.
14. Fasteners:
    a. Screws: ASTM C 1002, drywall screws, corrosion resistant. Provide types as recommended by manufacturer for each application.
       1) Wallboard to Metal Framing: Minimum 25 mm (1 inch), Type S.
       2) Wall board to Wood Framing: Minimum 32 mm (1-1/4 inch) Type W bugle head.

3) Wall board to Wallboard: Type G.
b. Nails: ASTM C 514.

15. Accessories: GA 216 and ASTM C 1047, galvanized steel.
a. Comer Bead: GA 216 Type CB-114 x 114.
b. Metal Trim (Casing Beads): GA 216 Type L, in depth to match gypsum-board thickness.
c. Control Joint: V-shaped control joint.
d. Adhesive: ASTM C 557 multi-purpose adhesive.

16. Finishing Materials: ASTM C 475.
a. Joint Tape: Provide type as recommended by panel manufacturer.
b. Joint Treatment: Joint compound, adhesive, water, and fasteners.

17. Sound-Isolation Materials:
a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral fiber blankets, 3.7 to 4.9 kg per sq m (3/4 to 1 PCF), thickness as indicated, scheduled, or required by fire-rated assembly.
b. Acoustical Sealant:
1) Concealed: ASTM C 919 nondrying, non-hardening, and non-skinning; non-bleeding; and non-staining.
2) Exposed: ASTM C 919 non-oxidizing and skinning; permanently elastic; and paintable.
c. Ductwork Penetrations Packing: Low-density fiberglass.

EXECUTION

Examination

18. Units, Spaces, and Areas to be Renovated: Comply with Detailed Scope of Work.
a. Existing Conditions: Before beginning installation, examine substrates and framing to receive gypsum board for defects or conditions adversely affecting quality and execution of installation.

Preparation

19. Dust Protection: Comply with Detailed Scope of Work.
20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
21. Protection: Comply with Detailed Scope of Work.
a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during drywall finishing operations.
22. Selective Demolition: Comply with Detailed Scope of Work.

Laying Out Work

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

Performance

24. Patching: Patch and extend existing work using skilled mechanics capable of matching existing quality of workmanship.
    a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
25. Damaged Surfaces: Comply with Detailed Scope of Work.
26. Transitions from Existing to New Work: Comply with Detailed Scope of Work.

Erection Of Drywall Stud Partitions

27. Reference Standard: Erect steel framing in accordance with ASTM C 754.
28. Layouts: Align partition studs accurately according to partition layout.
29. Anchoring: Anchor runner channels to concrete slabs with concrete stub nails or power-driven anchors at 600 mm (24 inches) OC. Anchor runner channels to coiling grid, where applicable, with stove bolts. Where studs extend above ceiling system, install headers where required to receive runners.
30. Studs: Position studs vertically in runners. Where studs are located adjacent to openings or partition intersections and comers. anchor studs to runners with manufacturer's metal lock fastener or with 13 mm (1/2 inch) Type S pan-head screws.
    a. Space studs at 400 mm (16 Inches) and 600 mm (24 inches) OC as indicated or scheduled.
        1) Cementitious Backer Units (CBU): Space studs at maximum of 400 mm (16 inches) OC.
        2) Limiting Heights: Comply with ASTM C 754 for transverse load of 240 Pa (5 lb-force/SF) without exceeding either allowable stress or deflection of L/240. Comers and Intersections: Locate studs no more than 50 mm (2 inches) from abutting partitions, comers, etc.
    b. Openings: Locate studs not more than 50 mm (2 inches) from opening frames. Anchor studs to frame anchor clips by bolt or screw attachment. Install headers over openings as recommended by the manufacturer.
        1) Solid-Core Wood Doors and Hollow Metal Doors: Provide two full-height studs at jambs fastened together back to back.
        2) Fire-Rated Openings: Comply with GA 219.
31. Bracing: Provide diagonal bracing at head of studs that terminate above the ceiling level. Bracing shall consist of metal studs bent to V-shape and extending at 45 degrees from partition head to structure above. Locate bracing 1 200 mm (48 inches) maximum OC.
32. Wood Blocking or Metal Reinforcement:
    a. Wood Blocking: See Division 6 Section "Rough Carpentry."
    b. Install metal reinforcement of size required for support of toilet and bath accessories, hardware, cabinets, shelving, counters, and other wall-mounted items.
    c. Set true to line, level, or plumb well-secured in stud wall and flush with back of drywall or other wall finish.
    d. Coordinate exact locations with other sections.

Miscellaneous Framing And Furring

33. General: Provide necessary framing and furring for special framing at recesses, offsets, specialty Items, and at wall-mounted casework, shelving, and equipment.
34. Furring Channels: Install furring channels over back-up material. Position channels vertically at 600 mm (24 inches) OC. Use power-activated fasteners or stub nails at 600 mm (24 Inches) OC along alternating flanges. Shim channels level as required.
    a. Cementitious Backer Units (CBU): Space furring at maximum of 400 mm (16 inches) OC.

35. Resilient Furring Channels: Screw-attach In accordance with manufacturer's recommendations.
    a. Spacing: 600 mm (24 inches) OC for framing at 16 inches OC and 400 mm (16 inches) OC for framing at 24 Inches OC.

Ceiling Grillage Erection

36. Reference Standard: Erect steel framing In accordance with ASTM C 754.
37. Hangers: Install wire hangers spaced not over 1 200 mm (48 inches) OC in direction of 38 mm (1-1/2 inch) main runner channels and within 150 mm (6 inches) of ends of main runners or interruptions of ceiling continuity. Hang from structure above.
38. Runners: Place main runners not over 1 200 mm (48 inches) OC. Provide, position, and level hangers with hangers saddle-tied along runners. Space furring channels at 600 mm (24 inches) OC at right angles to runner channels and secure with furring channel clips.
39. Reinforcement: At light troffers or other openings, reinforce grillage with 19 mm (314 inch) cold-rolled channels wired atop and parallel to main runner channels.
    a. Provide lateral seismic bracing as required by code.
40. Special Shapes: Provide necessary framing and suspension for off sets, verticals, etc.

Insulation

41. Sound Insulation: Place sound Insulation blankets in partitions tight within spaces, around cut openings. behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
    a. Ductwork Penetrations: Provide one-inch wide clearance around ductwork and pack with fiberglass ready for joint sealers.

Installation Of Gypsum Drywall

42. Reference Standards: Apply and finish gypsum board in accordance with GA 216 and ASTM C 840.
43. Partition Gypsum Board Layout: Apply gypsum wallboard panels vertically with abutting ends and edges occurring over stud flanges or furring.
    a. Joints on Opposite Sides of Partitions: Stagger; joints shall not occur over same stud.
    b. Two Layer Construction: Stagger Joints between layers.
44. Ceiling Gypsum Board: Apply gypsum board of maximum practical length with long dimensions at right angles to furring channels. End and edge joints shall occur over furring channels with end joints staggered. Properly support gypsum board around cutouts and openings.
45. Fasteners: Apply board to studs or furring with drywall screws spaced 300 mm (12 inches) OC in field of board and 200 mm (8 inches) OC staggered along abutting edges.
46. Water-Resistant: Apply gypsum wallboard manufacturer's recommended sealant to raw cut edges and screw heads.
47. Cementitious Backer Units (CBU): Install in accordance with ANSI A108.11 and manufacturer's recommendations.
48. Accessories:
    a. Comer Bead: Apply as recommended by manufacturer at exposed outer corners.
    b. Trim (Casing Beads): Apply as recomrnended by manufacturer, where gypsum board abuts other materials, and as indicated.
    c. Control Joints: Comply with GA 216.
        1) Walls: Install at not more than 9 m (30 feet) OC.
        2) Ceilings: Install at not more than 15 m (50 feet) OC and where framing changes direction.
        3) Coordinate locations with the Owner.
49. Access Panels: Securely install access panels furnished under other sections. Set plumb and square to align with finish surface.

50. Acoustical Sealant: Seal perimeter and penetrations on both sides of sound-rated partitions and partitions with sound-attenuation blankets with minimum of single 6 mm (1/4 inch) bead of sealant
    a. Locations:
        1) Seal around gypsum-board perimeter in angle formed by gypsum-board panels and abutting dissimilar materials.
        2) Seal intersections of gypsum board with dissimilar materials.
        3) Seal pipe. conduit, ductwork, penetrations, etc.
        4) Seal around cutouts for lights, cabinets, pipes, ductwork, electrical boxes, etc.
        5) Seal gypsum board panel terminations in door and window frarnes.
        6) Seal control-joint locations before installing control Joints to panels.
    b. Installation: Comply with ASTM C 919 and requirements of indicated sound-rated assembly. Provide number and positions of beads to comply with sound rating of assembly.
51. Tolerances: Gypsum-board surface plane within plus or minus 3 mm in 3 000 mm (1/8 inch in 10 feet).
52. Finishing: Finish in accordance with GA 214.
    a. Concealed Locations (Not Exposed to View in Rooms): Level 1
    b. Beneath Tile: Level 2.
    c. Other Finished Areas: Level 4. Finish joints, trim, and fastener dimples. Sand smooth.
    d. Cementitious Backer Units (CBU): Treat joints in accordance with ANSI A108.11 and manufacturer's recommendations.

END OF SECTION 09 23 13 00

Task	Specification	Specification Description
09 23 13 00	09 22 13 13	Gypsum Plaster
09 23 13 00	09 22 13 13a	Gypsum Veneer Plaster
09 23 13 00	09 22 13 13b	Portland Cement Plaster
09 23 13 00	09 22 36 23	Lath and Plaster Renovation
09 24 13 00	09 22 13 13	Gypsum Plaster
09 24 13 00	09 22 13 13a	Gypsum Veneer Plaster
09 24 33 00	01 22 16 00	No Specification Required

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SECTION 09 28 13 00 - GYPSUM BOARD

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Interior gypsum board.
b. Exterior gypsum board for ceilings and soffits.
c. Tile backing panels.

C. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For the following products:
a. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
b. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.
3. LEED Submittals:
a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement indicating costs for each product having recycled content.
b. Product Data for Credit EQ 4.1: For adhesives used to laminate gypsum board panels to substrates, including printed statement of VOC content.

D. Quality Assurance
1. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

E. Storage And Handling
1. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

F. Project Conditions
1. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
2. Do not install interior products until installation areas are enclosed and conditioned.
3. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.2 PRODUCTS

A. Panels, General
1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Interior Gypsum Board
1. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
2. Regular Type:
   a. Thickness: 1/2 inch (12.7 mm).
   b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
3. Type X:
   a. Thickness: 5/8 inch (15.9 mm).
   b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
4. Type C:
   a. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   b. Long Edges: Tapered.
5. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   a. Thickness: 1/4 inch (6.4 mm).
   b. Long Edges: Tapered.
6. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   a. Thickness: 1/2 inch (12.7 mm).
   b. Long Edges: Tapered.
7. Foil-Backed Type:
   a. Core: As indicated on Drawings **OR** 3/8 inch (9.5 mm), regular type **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X **OR** Type C as required by fire-resistance-rated assembly indicated on Drawings, **as directed**.
   b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
8. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
   a. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
   b. Long Edges: Tapered.
9. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
   a. Core: As indicated on Drawings **OR** 5/8 inch (15.9 mm) thick, **as directed**.
   b. Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.
10. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
    a. Core: 5/8 inch (15.9 mm), Type X.
    b. Long Edges: Tapered.

C. Exterior Gypsum Board For Ceilings And Soffits
1. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

1) Core: As indicated **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.

2. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
   a. Core: As indicated **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.

D. Tile Backing Panels
1. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
   a. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X **OR** Type C as required by fire-resistance-rated assembly indicated on Drawings, **as directed**.
2. Glass-Mat, Water-Resistant Backing Board:
   a. Complying with ASTM C 1178/C 1178M.
   b. Complying with ASTM C1177/C 1177M.
   c. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
3. Cementitious Backer Units: ANSI A118.9.
   a. Thickness: As indicated on Drawings **OR** 1/2 inch (12.7 mm), **as directed**.

E. Trim Accessories
1. Interior Trim: ASTM C 1047.
   a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
   b. Shapes:
      1) Cornerbead.
      2) Bullnose bead.
      3) LC-Bead: J-shaped; exposed long flange receives joint compound.
      4) L-Bead: L-shaped; exposed long flange receives joint compound.
      5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
      6) Expansion (control) joint.
      7) Curved-Edge Cornerbead: With notched or flexible flanges.
2. Exterior Trim: ASTM C 1047.
   a. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
   b. Shapes:
      1) Cornerbead.
      2) LC-Bead: J-shaped; exposed long flange receives joint compound.
      3) Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
3. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   b. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

F. Joint Treatment Materials
1. General: Comply with ASTM C 475/C 475M.
2. Joint Tape:
   a. Interior Gypsum Wallboard: Paper.
   b. Exterior Gypsum Soffit Board: Paper.
   c. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   d. Tile Backing Panels: As recommended by panel manufacturer.
3. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   a. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping **OR** drying-type, all-purpose, **as directed**, compound.
   1) Use setting-type compound for installing paper-faced metal trim accessories.
c. Fill Coat: For second coat, use setting-type, sandable topping **OR** drying-type, all-purpose, **as directed**, compound.
d. Finish Coat: For third coat, use setting-type, sandable topping **OR** drying-type, all-purpose, **as directed**, compound.
e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound **OR** drying-type, all-purpose compound **OR** high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish, **as directed**.

4. Joint Compound for Exterior Applications:
   a. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
   b. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
5. Joint Compound for Tile Backing Panels:
   a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
   b. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   c. Cementitious Backer Units: As recommended by backer unit manufacturer.

G. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
2. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   b. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
4. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
5. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants".
   a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation".
7. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation".

H. Texture Finishes
1. Primer: As recommended by textured finish manufacturer.
2. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.
   a. Texture: Fine **OR** Medium **OR** Coarse, **as directed**.
3. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.

a. Texture: Light spatter **OR** Spatter knock-down, **as directed**.

4. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.
   a. Application Thickness: 1/2 inch (12.7 mm).
   b. Fire-Test-Response Characteristics: Indices when tested according to ASTM E 84 as follows:
      1) Flame Spread: Less than 25.
      2) Smoke Developed: Less than 450.
   c. NRC: 0.55 according to ASTM C 423.

1.3 EXECUTION

A. Examination
1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
2. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Applying And Finishing Panels, General
1. Comply with ASTM C 840.
2. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
4. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
5. Form control and expansion joints with space between edges of adjoining gypsum panels.
6. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   b. Fit gypsum panels around ducts, pipes, and conduits.
   c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
7. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
8. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
9. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.
10. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

11. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Applying Interior Gypsum Board
1. Install interior gypsum board in the following locations:
   a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
   b. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
   c. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
   d. Flexible Type: As indicated on Drawings **OR** Apply in double layer at curved assemblies, **as directed**.
   e. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
   f. Foil-Backed Type: As indicated on Drawings **OR as directed**.
   g. Abuse-Resistant Type: As indicated on Drawings **OR as directed**.
   h. High-Impact Type: As indicated on Drawings **OR as directed**.
   i. Moisture- and Mold-Resistant Type: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:
   a. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   b. On partitions/walls, apply gypsum panels vertically (parallel to framing) **OR** horizontally (perpendicular to framing), **as directed**, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
      2) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   c. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   d. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
3. Multilayer Application:
   a. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   b. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   c. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   d. Fastening Methods: Fasten base layers and face layers separately to supports with screws **OR** Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners, **as directed**.
4. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
5. Curved Surfaces:

a. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
b. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

D. Applying Exterior Gypsum Panels For Ceilings And Soffits
1. Apply panels perpendicular to supports, with end joints staggered and located over supports.
a. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
b. Fasten with corrosion-resistant screws.

E. Applying Tile Backing Panels
1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated **OR** locations indicated to receive tile, **as directed**. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
3. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated **OR** locations indicated to receive tile, **as directed**.
4. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
5. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

F. Installing Trim Accessories
1. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
2. Control Joints: Install control joints at locations indicated on Drawings **OR** according to ASTM C 840 and in specific locations approved by the Owner for visual effect, **as directed**.
3. Interior Trim: Install in the following locations:
a. Cornerbead: Use at outside corners, unless otherwise indicated.
b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
c. LC-Bead: Use at exposed panel edges.
d. L-Bead: Use where indicated.
e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
f. Curved-Edge Cornerbead: Use at curved openings.
4. Exterior Trim: Install in the following locations:
a. Cornerbead: Use at outside corners.
b. LC-Bead: Use at exposed panel edges.
5. Aluminum Trim: Install in locations indicated on Drawings.

G. Finishing Gypsum Board
1. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
2. Prefill open joints, rounded or beveled edges, and damaged surface areas.
3. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
4. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
a. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
b. Level 2: Panels that are substrate for tile **OR** Panels that are substrate for acoustical tile **OR** Where indicated on Drawings, **as directed**.

c. Level 3: For surfaces receiving medium- or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical **OR** Where indicated on Drawings, **as directed**.
d. Level 4: For surfaces receiving light-textured finishes, wallcoverings, and flat paints **OR** At panel surfaces that will be exposed to view, unless otherwise indicated, **as directed**. This is generally the standard exposed finish. Gloss and semi-gloss enamel paints are not usually recommended over this level of finish. ASTM C 840 requires application of "drywall primer" on surfaces before final decoration
    1) Primer and its application to surfaces are specified in other Division 07.
e. Level 5: For surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting **OR** Where indicated on Drawings, **as directed**.
    1) Primer and its application to surfaces are specified in other Division 07.
f. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
g. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
h. Cementitious Backer Units: Finish according to manufacturer's written instructions.

H. Applying Texture Finishes
1. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
2. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
3. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

I. Protection
1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
2. Remove and replace panels that are wet, moisture damaged, and mold damaged.
    a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
    b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 28 13 00

SECTION 09 28 13 00a - GYPSUM BOARD SHAFT-WALL ASSEMBLIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for gypsum board shaft-wall assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes gypsum board shaft-wall assemblies for the following:
   a. Shaft-wall enclosures.
   b. Chase enclosures.
   c. Stair enclosures.
   d. Horizontal enclosures.

C. Submittals
1. Product Data: For each gypsum board shaft-wall assembly indicated.
2. LEED Submittals:
   a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
   b. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance
1. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.
2. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions
1. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
2. Do not install interior products until installation areas are enclosed and conditioned.
3. Do not install panels that are wet, moisture damaged, or mold damaged.
   a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
   b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

A. Gypsum Board Shaft-Wall Assemblies, General
   1. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
      a. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
      b. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

B. Panel Products
   1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
   2. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.
      a. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
         1) Core: 1 inch (25.4 mm) thick.
         2) Long Edges: Double bevel.
      b. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.
         1) Core: 1 inch (25.4 mm) thick.
         2) Long Edges: Double bevel.
   3. Gypsum Base for Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering".
   4. Gypsum Board: As specified in Division 09 Section "Gypsum Board".
   5. Water-Resistant Gypsum Backing Board: As specified in Division 09 Section "Gypsum Board".
   6. Cementitious Backer Units: As specified in Division 09 Section "Tiling".

C. Non-Load-Bearing Steel Framing
   1. Framing Members: Comply with ASTM C 754 for conditions indicated.
   2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
      a. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
      b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.

D. Auxiliary Materials
   1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
   2. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section(s) "Gypsum Veneer Plastering" OR "Gypsum Board", **as directed**, that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
   3. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering".
   4. Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering".
   5. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board".
   6. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.
      a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   a. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
8. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
   a. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
   b. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
9. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
10. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
    a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Gypsum Board Shaft-Wall Assemblies
1. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing agency.
2. Fire-Resistance Rating: As indicated **OR** 1 hour **OR** 2 hours **OR** 3 hours **OR** 4 hours, **as directed**.
3. STC Rating: As indicated **OR** 51, minimum, **as directed**.
4. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
   a. Depth: As indicated **OR** 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
   b. Minimum Base-Metal Thickness: As indicated **OR** 0.0179 inch (0.45 mm) **OR** 0.0220 inch (0.55 mm) **OR** 0.0329 inch (0.84 mm), **as directed**.
5. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.
   a. Minimum Base-Metal Thickness: As indicated **OR** Matching steel studs **OR** 0.0179 inch (0.45 mm) **OR** 0.0220 inch (0.55 mm) **OR** 0.0329 inch (0.84 mm), **as directed**.
6. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
7. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76 mm), in depth matching studs, and not less than 0.0329 inch (0.84 mm) thick.
8. Room-Side Finish: As indicated **OR** Gypsum board **OR** Gypsum veneer plaster **OR** Cementitious backer units, **as directed**.
9. Shaft-Side Finish: As indicated **OR** As indicated by fire-resistance-rated assembly design designation, **as directed**.
10. Insulation: Sound attenuation blankets.

2.2 EXECUTION

A. Preparation

1. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 07 Section "Applied Fireproofing".
   a. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runner tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft-wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

B. Installation
1. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
   a. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
   b. Division 09 Section(s) "Gypsum Veneer Plastering" OR "Gypsum Board", **as directed**, for applying and finishing panels.
   c. Division 09 Section "Tiling" for cementitious backer units.
2. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.
3. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
   a. At elevator hoistway entrance door frames, provide jamb struts on each side of door frame.
   b. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch (0.79-mm) minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum base for veneer plaster **OR** gypsum board **OR** cementitious backer unit, **as directed**, face-layer panel.
4. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.
5. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
6. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
7. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
8. Control Joints: Install control joints at locations indicated on Drawings **OR** according to ASTM C 840 and in specific locations approved by the Owner, **as directed**, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.
9. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.
10. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches (102 mm) of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- (13- or 16-mm-) thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).

a. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft-wall framing.
b. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft-wall framing.

11. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

C. Protection

1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
2. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
   b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 28 13 00a

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Task	Specification	Specification Description
09 28 13 00	09 22 13 13a	Gypsum Veneer Plaster
09 28 13 00	09 01 30 91	Ceramic Tile
09 29 10 00	01 22 16 00	No Specification Required
09 29 10 00	09 28 13 00	Gypsum Board
09 29 10 00	09 23 13 00	Gypsum Board Renovation
09 29 10 00	09 28 13 00a	Gypsum Board Shaft-Wall Assemblies
09 29 82 00	09 28 13 00	Gypsum Board
09 29 82 00	09 28 13 00a	Gypsum Board Shaft-Wall Assemblies
09 30 13 00	09 01 30 91	Ceramic Tile
09 30 16 00	09 01 30 91	Ceramic Tile
09 34 00 00	09 01 30 91	Ceramic Tile
09 39 00 00	01 22 16 00	No Specification Required
09 39 00 00	09 01 30 91	Ceramic Tile

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SECTION 09 51 13 00 - ACOUSTICAL PANEL CEILINGS

1.1 GENERAL

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

B. Summary
1. This Section includes acoustical panels and exposed suspension systems for ceilings.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions
1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals
1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:
3. Samples: For each exposed finish.
4. LEED Submittals:
   a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      1) Include statement indicating costs for each product having recycled content.
   b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
5. Product test reports.
6. Research/evaluation reports.
7. Maintenance data.

E. Quality Assurance
1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics
   a. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
      1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
      2) Identify materials with appropriate markings of applicable testing and inspecting agency.
   b. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR** B **OR** C, **as directed**, materials as determined by testing identical products per ASTM E 84:
      1) Smoke-Developed Index: 450 or less.

3. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
   c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
   d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
   e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Panels, General
1. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   a. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
4. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

B. Acoustical Panels For Acoustical Panel Ceiling
1. Classification: Provide fire-resistance-rated, **as directed**, panels complying with ASTM E 1264 for type, form, and pattern as follows:

a. Type and Form: Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
b. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with glass-fiber cloth **OR** washable vinyl-film, **as directed**, overlay.
c. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face **OR** vinyl overlay on face and back **OR** vinyl overlay on face, back, and sealed edges **OR** fiberglass-fabric overlay on face, **as directed**.
d. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 1, plastic **OR** 2, cloth **OR** 3, other, **as directed**.
e. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
f. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** GH (smooth and printed) **OR** I (embossed) **OR** J (embossed-in-register) **OR** K (surface scored) **OR** Z (other patterns as described) **OR** As indicated by manufacturer's designation, **as directed**.

2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90, **as directed**.
4. NRC: Not less than 0.10 **OR** 0.35 **OR** 0.40 **OR** 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95 **OR** 1.00, **as directed**.
5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
7. Edge/Joint Detail: Square **OR** Reveal sized to fit flange of exposed suspension system members **OR** Flush reveal sized to fit flange of exposed suspension system members **OR** Beveled, kerfed and rabbeted long edges and square, butt-on short edges, **as directed**.
8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** 7/8 inch (22 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
9. Thickness (For glass-fiber-based panels): 1/8 inch (3 mm) **OR** 9/16 inch (15 mm) **OR** 5/8 inch (15 mm) **OR** 7/16 inch (22 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
10. Modular Size: 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 600 by 600 mm **OR** 600 by 1200 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
11. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.

C. Metal Suspension Systems, General
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
   a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per

ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
      OR
      Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
      OR
      Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
11. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
12. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
13. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard **OR** closed-cell PVC **OR** neoprene **OR** antimicrobial, **as directed**, gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

D. Metal Suspension System For Acoustical Panel Ceiling

1. Wide-Face, Capped, Double-Web, Fire-Rated, **as directed**, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
   c. Face Design: Flat, flush.
   d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
   e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match

color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.

2. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
   c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
   d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
   e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
3. Narrow-Face, Steel-Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide metal caps on flanges.
   a. Structural Classification: Intermediate-duty system.
   b. Face Design: Flat, flush.
   c. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange **OR** Flanges formed in stepped design with a center protrusion projecting 19/64 inch (7.54 mm) below flange surfaces supporting panel faces and forming 3/16-inch- (4.76-mm-) wide reveals between edges of protrusion and those of panels, **as directed**.
   c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of acoustical unit, **as directed**.
   d. Reveal Finish: Painted to match flange color **OR** white **OR** black **OR** in color other than flange color as selected from manufacturer's full range of contrasting reveal colors, **as directed**.
5. Wide-Face, Capped, Double-Web, Fire-Rated, **as directed**, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide, aluminum caps on flanges.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. Face Design: Flat, flush.
   c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
6. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet electrolytically zinc coated, with prefinished flanges of width indicated.
   a. Structural Classification: Heavy-duty system.
   b. Face Finish: Painted white **OR** black, **as directed**.

7. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from Type 304 or 316, stainless-steel sheet, with prefinished 15/16-inch- (24-mm-) wide, stainless-steel caps on flanges.
   a. Structural Classification: Intermediate-duty system.
   b. Face Design: Flat, flush.
8. Narrow-Face, Single-Web, Extruded-Aluminum Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with 9/16-inch- (15-mm-) wide faces.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. Face Design: Screw-slot profile.
   c. Face Finish: Painted white **OR** Satin anodized per AA-M12C22A31 and AAMA 611, **as directed**.
   d. Reveal Finish: Match face finish **OR** Painted white **OR** Painted black, **as directed**.
9. Extra-Wide-Face, Double-Web **OR** Single-Web, **as directed**, Metal Suspension System: Main and cross runners formed from extruded aluminum **OR** aluminum-capped steel **OR** steel-capped steel, **as directed**, to produce structural members with 1-1/2-inch- (50-mm-) **OR** 2-inch- (50-mm-), **as directed**, wide flanges.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. Face Design: Flat, flush.
   c. Face Finish: Painted white **OR** Satin anodized per AA-M12C22A31 and AAMA 611, **as directed**.
   d. Gasket System: Clean-room type.

E. Metal Edge Moldings And Trim
1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   a. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
   b. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
   a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
   b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
   c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
   d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):
      1) Manufacturer's standard, factory-applied prime-coat finish ready for field painting.
   e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
   1) Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant
1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

1.3 EXECUTION

A. Preparation
1. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Installation
1. General: Install acoustical panel ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
2. Suspend ceiling hangers from building's structural members and as follows:
   a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   c. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   d. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   e. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   f. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   g. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

h. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
i. Do not attach hangers to steel deck tabs.
j. Do not attach hangers to steel roof deck. Attach hangers to structural members.
k. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
l. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
6. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   a. Arrange directionally patterned acoustical panels as follows:
      1) As indicated on reflected ceiling plans.
         OR
         Install panels with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
         OR
         Install panels in a basket-weave pattern.
   b. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   c. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   d. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
   e. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   f. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
   g. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
   h. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

C. Field Quality Control
   1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
   a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
      1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
      2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
3. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

D. Cleaning
1. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

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SECTION 09 51 23 00 - ACOUSTICAL TILE CEILINGS

1.1 GENERAL

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

B. Summary
1. This Section includes acoustical tiles for ceilings and the following:
   a. Concealed suspension systems.
   b. Direct attachment of tiles to substrates with adhesive.
   c. Direct attachment of tiles to substrates with staples.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions
1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light-Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals
1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.
3. Samples: For each exposed finish.
4. LEED Submittals:
   a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      1) Include statement indicating costs for each product having recycled content.
   b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
5. Field quality-control test reports.
6. Product test reports.
7. Research/evaluation reports.
8. Maintenance data.

E. Quality Assurance
1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
   a. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
      1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

2) Identify materials with appropriate markings of applicable testing and inspecting agency.

b. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR** B **OR** C, **as directed**, materials as determined by testing identical products per ASTM E 84:

1) Smoke-Developed Index: 450 or less.

3. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
   c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
   d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
   e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Tiles, General
1. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
   a. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
4. Antimicrobial Fungicide Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide

added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

B. Acoustical Tiles For Acoustical Tile Ceiling
1. Classification: Provide fire-resistance-rated, **as directed**, tiles complying with ASTM E 1264 for type, form, and pattern as follows:
   a. Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
   b. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** I (embossed) **OR** J (embossed-in-register) **OR** As indicated by manufacturer's designation, **as directed**.
2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80, **as directed**.
4. NRC: Not less than 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70, **as directed**.
5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
7. Edge/Joint Detail: Square, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted long edges and square, butt on short edges, **as directed**.
8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
9. Modular Size: 12 by 12 inches (305 by 305 mm) **OR** 300 by 300 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
10. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.

C. Metal Suspension Systems, General
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
      2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
      3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
   b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without

failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
9. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

D. Metal Suspension System For Acoustical Tile Ceiling
1. Direct-Hung, Double-Web, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. Access: Upward **OR** Downward, **as directed**, and end pivoted, **OR** side pivoted, **as directed**, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
2. Indirect-Hung, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
   a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
   b. Carrying Channels: Cold-rolled steel, 0.059850-inch- (1.52-mm-) minimum base (uncoated) metal thickness, not less than 3/16-inch- (4.7-mm-) wide flanges by 1-1/2-inch- (38-mm-) deep steel channels, 475 lb/1000 feet (0.707 kg/m), with rust-inhibitive paint finish **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**.
   c. Access: Where access is indicated, provide special cross runners or split splines to allow for removal of acoustical units in indicated access areas. Identify access tile with manufacturer's standard unobtrusive markers for each access unit.

E. Metal Edge Moldings And Trim
1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   a. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
   b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
   a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability

properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).

d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):

1) Manufacturer's standard factory-applied prime-coat finish ready for field painting.

e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1) Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

G. Miscellaneous Materials

1. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.

a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

1.3 EXECUTION

A. Preparation

1. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

2. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

B. Installation, Suspended Acoustical Tile Ceilings

1. General: Install acoustical tile ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

2. Suspend ceiling hangers from building's structural members and as follows:

a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
OR
Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
e. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
f. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
g. Do not attach hangers to steel deck tabs.
h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
   a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
6. Arrange directionally patterned acoustical tiles as follows:
   a. As indicated on reflected ceiling plans.
   OR
   Install tiles with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
   OR

Install tiles in a basket-weave pattern.

7. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
   a. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
   b. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
   c. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

C. Installation, Directly Attached Acoustical Tile Ceilings
1. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of adhesive and procedure recommended in writing by tile manufacturer and as follows:
   a. Remove loose dust from backs of tiles by brushing and prime them with a thin coat of adhesive.
   b. Install splines in joints between tiles; maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively.
   c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
2. Stapled Installation: Fasten acoustical tile to substrate using a minimum of two staples per tile that are installed in flanges of tile and as follows:
   a. Form double-lapped joint between tiles by securely pressing tile tongues into corresponding tile grooves.
   b. Maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively. Shim tile or correct substrate as required to maintain tolerance.
   c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
3. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
4. Arrange directionally patterned acoustical tiles as follows:
   a. As indicated on reflected ceiling plans.
      OR
      Install tiles with pattern running in one direction parallel to long axis of space.
      OR
      Install tiles with pattern running in one direction parallel to short axis of space.
      OR
      Install tiles in a basket-weave pattern.

D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
2. Tests and Inspections: Testing and inspecting of completed installations of acoustical tile ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
   a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed.
      1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
      2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

3. Remove and replace acoustical tile ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

E. Cleaning
1. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23 00

Task	Specification	Specification Description
09 53 23 00	09 51 13 00	Acoustical Panel Ceilings

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SECTION 09 54 23 00 - ACOUSTICAL METAL PAN CEILINGS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for acoustical metal pan ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section includes clip-in, lay-in, snap-in, and torsion-spring acoustical metal pans and the following suspension system for ceilings:
   a. Direct hung, exposed tee and slot-bolt grid.
   b. Direct-hung and Indirect-hung, concealed grid designed to support metal pans.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions
1. CAC: Ceiling Attenuation Class.
2. LR: Light Reflectance coefficient.
3. NRC: Noise Reduction Coefficient.

D. Performance Requirements
1. Structural Performance: Exterior snap-in metal pan ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
   a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 100 deg F (55 deg C).

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
   a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      1) Include statement indicating costs for each product having recycled content.
   b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Samples: For each exposed finish.
4. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Drawn to scale and coordinating and showing the following:
   a. Ceiling suspension members.
   b. Method of attaching hangers to building structure.
   c. Ceiling-mounted items.
   d. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.
6. Product test reports.

7. Evaluation reports.
8. Field quality-control reports.
9. Maintenance data.

F. Quality Assurance
1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
3. Seismic Standard: Provide acoustical metal pan ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
   c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
   d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
   e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling
1. Deliver acoustical metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Handle acoustical metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Acoustical Metal Ceiling Pans
1. Acoustical Metal Pan Standard: Provide manufacturer's standard acoustical metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
   a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
   a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
   b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.

1) Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2) Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 591/A 591M, 40Z (12G) coating, surface treatment as recommended by finish manufacturer for type of use and finish indicated.
3) Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A 1008/A 1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.

c. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.

3. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
   a. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.
4. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
   a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
      1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
      2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
      3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
   b. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C 553, Type I, II, or III; not less than 1-lb/cu. ft. (16-kg/cu. m) density; treated to be nondusting; and as follows:
      1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
   c. Spacer Grids: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.
   d. Sound Attenuation Panels: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, unperforated metal backing unit that acts as a sound-attenuating pan to reduce the travel of sound through ceiling plenum into adjoining rooms.
      1) Sound-Absorbent Pads: Provide secondary sound-absorbent pads, same as specified for primary pads, for placement over sound attenuation pan to reduce plenum sound.

B. Aluminum Pans For Acoustical Metal Pan Ceiling
1. Classification: Units complying with ASTM E 1264 for Type VII, perforated aluminum facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated aluminum facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated aluminum facing (pan) units, **as directed**.
   a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
   OR

Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.

2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
   a. Lay-in Pans: Formed to set in exposed suspension grid.
   b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
   c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
   d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.020 inch (0.5 mm) **OR** 0.025 inch (0.6 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
   OR
   Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

C. Steel Pans For Acoustical Metal Pan Ceiling
1. Classification: Units complying with ASTM E 1264 for Type V, perforated steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated steel facing (pan) units, **as directed**.
   a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
      OR
      Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
   a. Lay-in Pans: Formed to set in exposed suspension grid.
   b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
   c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.

d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.

3. Pan Thickness: Not less than 0.010-inch (0.25-mm) **OR** 0.020-inch (0.5-mm) **OR** 0.024-inch (0.6-mm) **OR** 0.030-inch (0.75-mm) **OR** 0.036-inch (0.9-mm), **as directed**, nominal thickness.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
   OR
   Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

D. Stainless-Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type VI, perforated stainless-steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated stainless-steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated stainless-steel facing (pan) units, **as directed**.
   a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in parallel alignment to pan edge with uniform perforations of 0.109-inch (2.8-mm) diameter, 1800 holes/sq. ft. or inch, and 11.8 percent open area.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
   a. Lay-in Pans: Formed to set in exposed suspension grid.
   b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
   c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
   d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.019 inch (0.5 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.030 inch (0.76 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
   OR
   Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.

8. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
9. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

E. Metal Suspension Systems
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
3. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
      2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
      3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
      4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
   b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical metal pans in place.
11. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place to molding and trim at perimeter **OR** at each pan, **as directed**.

12. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units, unless otherwise indicated.
    a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

F. Direct-Hung, Standard-Grid, Metal Suspension System For Acoustical Metal Pan Ceiling
1. Suspension System: For clip-in **OR** lay-in **OR** torsion-spring, **as directed**, pans.
2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide sheet metal caps on flanges.
    a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
    b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
    c. Face Design: Flat, flush.
    d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
    e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
3. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide sheet metal caps on flanges.
    a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
    b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
    c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
    d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
    e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
    a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
    b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange, **as directed**.
    c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of metal pan, **as directed**.
5. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide aluminum caps on flanges.
    a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
    b. Face Design: Flat, flush.
    c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
6. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from and capped with Type 304 or 316 stainless-steel sheet, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide stainless-steel caps on flanges.

a. Structural Classification: Intermediate-duty system.
b. Face Design: Flat, flush.

7. Suspension System for Torsion-Spring Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring attachment.

G. Metal Suspension System For Acoustical Snap-In Metal Pan Ceiling

1. Indirect-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners connected to carrying channels that are attached by hangers to building structure, and complying with the following requirements:
   a. Main Runners: Formed from the following metal:
      1) Aluminum Sheet: Alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
      2) Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, with not less than 80Z (24G) zinc coating.
      3) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180) zinc coating.
      4) Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher leveled, with cold-rolled mill finish.
      5) Metal Sheet: Metal as standard with ceiling system manufacturer with factory-applied protective finish complying with ASTM C 635.
   b. Carrying Channels: Same member and metal as indicated for main runners.
      OR
      Carrying Channels: Cold-rolled steel, not less than 0.060-inch (1.5-mm) nominal thickness of base (uncoated) metal and 7/16-inch- (11-mm-) wide flanges, protected with rust-inhibitive paint **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**, and as follows:
      1) Depth and Weight: 1-1/2 inches and 475 lb/1000 feet (38 mm and 215 kg/305 m) **OR** 2 inches and 590 lb/1000 feet (51 mm and 268 kg/305 m), **as directed**.
   c. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
2. Direct-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners supported by hangers attached directly to building structure, and complying with the following requirements:
   a. Hangers: Angles or channels, as standard with ceiling system manufacturer, formed from same metal as main runners.
   b. Main Runners: Rolled aluminum sheet; alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
3. Access Panels: For access at locations indicated, provide acoustical snap-in metal pan ceiling units, accessible by key or tool **OR** two access knobs; place one access knob at each end of panel near corners, **as directed**.
   a. Access Key or Tool: Provide manufacturer' standard key or tool for opening access panels; one **OR** two, **as directed**.

H. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or

less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

I. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Aluminum Finishes
1. Mill Finish: AA-M10C10 (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned).
2. Lacquered Mill Finish: AA-M10C10R1x (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned; Organic Coating: as specified below).
   a. Organic Coating: Manufacturer's standard clear organic coating.
3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
5. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
6. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

K. Galvanized-Steel Sheet Finishes
1. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

L. Steel Sheet Finishes
1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

M. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Preparation
1. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and Coordination Drawings.

B. Installation
1. Install acoustical metal pan ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
   a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
      OR
      Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
   e. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   f. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   g. Do not attach hangers to steel deck tabs.
   h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
   j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
   a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

6. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
7. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim.
   a. For lay-in square-edge pans, install pans with edges fully hidden from view by flanges of suspension system runners and moldings.
   b. For lay-in reveal-edge pans on suspension system runners, install pans with bottom of reveal in firm contact with top surface of runner flanges.
   c. For lay-in reveal-edge pans on suspension system members with box-shaped flanges, install pans with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
   d. For clip-in **OR** torsion-spring-hinged, **as directed**, pans, position pans according to manufacturer's written instructions.
   e. For snap-in pans, fit adjoining units to form flush, tight joints.
   f. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
   g. Fit adjoining units to form flush, tight joints.
   h. Install directionally patterned or textured metal pans in directions indicated.
   i. Install sound-absorbent fabric layers in perforated metal pans.
   j. Install sound-absorbent pads in perforated metal pans over metal spacer grids, **as directed**.
8. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas. Lay second sound-absorbent pads on sound attenuation panels.
9. Install hold-down clips where indicated.

C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
   a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
      1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
      2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
3. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

D. Cleaning
1. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 54 23 00

SECTION 09 54 23 00a - LINEAR METAL CEILINGS

1.1 GENERAL

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

B. Summary
1. Section includes strip linear metal pans and suspension systems for ceilings.

C. Definitions
1. LR: Light Reflectance coefficient.
2. NRC: Noise Reduction Coefficient.

D. Performance Requirements
1. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
   a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), **as directed**, material surfaces.

E. Submittals
1. Product Data: For each type of product indicated.
2. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Samples: For each exposed finish.
4. Coordination Drawings: Drawn to scale and coordinating and showing the following:
   a. Linear pattern.
   b. Joint pattern.
   c. Ceiling suspension members.
   d. Method of attaching hangers to building structure.
   e. Ceiling-mounted items.
   f. Ceiling perimeter and penetrations through ceiling; trim and moldings.
5. Product test reports.
6. Evaluation reports.
7. Maintenance data.

F. Quality Assurance
1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.
2. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials, as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

3. Seismic Standard: Comply with the following:
   a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
   c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
   d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
   e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

G. Delivery, Storage, And Handling
1. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Linear Metal Ceiling Pans
1. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of configuration indicated that comply with ASTM E 1264.
   a. Mounting Method for Measuring NRC: Type E-400.
2. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
   a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
   b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.
   c. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled and ASTM A 591/A 591M, 40Z (12G) coating for painted finish **OR** ASTM A 1008/A 1008M for electroplating, **as directed**; with protective coating complying with ASTM C 635 and recommended by finisher for finish indicated.
   d. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.
3. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.
4. Pan Splices: Construction same as pans, in lengths 8 to 12 inches (200 to 300 mm); with manufacturer's standard finish.
5. End Caps: Metal matching pans **OR** Plastic **OR** Manufacturer's standard material, **as directed**; fabricated to fit and conceal exposed ends of pans.
6. Filler Strips: Metal matching pans **OR** Plastic **OR** Manufacturer's standard material, **as directed**; fabricated to uninterruptedly close voids between pans.
7. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.

8. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
   a. Bond fabric layer to pan in the factory with manufacturer's standard nonflammable adhesive.
9. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
   a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
      1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
      2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
      3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
   b. Unwrapped, Glass-Fiber Insulation: Black-coated, unfaced, glass-fiber insulation complying with ASTM C 553, Type I, II, or III, not less than 1-lb/cu. ft. (16-kg/cu. m) density, treated to be nondusting, and as follows:
      1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.

B. Metal Suspension Systems
1. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635 requirements.
2. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
3. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
   a. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
      2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC service condition (mild).
      3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
      4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
   b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
4. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:
   a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.

d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.

5. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
6. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed from 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
7. Carriers: Factory finished with matte-black baked finish, **as directed**.
   a. Main Carriers: Aluminum, not less than 0.240-inch (6.0-mm) rolled sheet, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209 (ASTM B 209M).
   b. Main Carriers: Steel, not less than 0.0209-inch (0.53-mm) nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C 635.
      1) Electrolytic Zinc-Coated Steel: ASTM A 591/A 591M, not less than 80Z (24G), **as directed**, zinc coating.
      2) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180), **as directed**, zinc coating.
   c. Adaptable Carriers: Manufacturer's standard carriers for direct attachment to existing suspended tees.
   d. Flexible Radial Carriers: Manufacturer's standard radial carriers.
   e. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.
8. Carrier Splices: Same metal, profile, and finish as indicated for carriers.
9. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.
10. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
11. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
12. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.
13. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.
    a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

C. Aluminum Pans And Suspension System For Linear Metal Ceiling
1. Aluminum Pans and Suspension System:
2. Classification: Units complying with ASTM E 1264 for Type XIII, aluminum strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, aluminum strips with mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated aluminum strips with sound-absorbent fabric backing, **as directed**.
3. Pan Thickness: Not less than 0.018 inch (0.46 mm) **OR** 0.022 inch (0.56 mm) **OR** 0.024 inch (0.6 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
4. Pan Edge Detail: Beveled **OR** Square **OR** Round **OR** Manufacturer's standard edge detail, **as directed**.

5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** 100-mm module width and 80-mm face width **OR** 200-mm module width and 180-mm face width **OR** 300-mm module width and 280-mm face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** 3/4 inch (19 mm) deep **OR** Not less than 1 to 1-1/2 inches (25 to 38 mm) deep **OR** 15 mm deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** High-performance organic coating in color selected from manufacturer's full range **OR** Bright-reflective finish selected from manufacturer's full range, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. LR: Not less than 0.70 **OR** 0.75, **as directed**.
12. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
13. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

D. Steel Pans And Suspension System For Linear Metal Ceiling
1. Steel Pans and Suspension System:
2. Classification: Units complying with ASTM E 1264 for Type XIII, steel strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, steel strips with mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated steel strips with sound-absorbent fabric backing, **as directed**.
3. Pan Thickness: Not less than 0.015 inch (0.4 mm) **OR** 0.020 inch (0.5 mm) **OR** 0.024 inch (0.6 mm) **OR** 0.030 inch (0.75 mm), **as directed**.
4. Pan Edge Detail: Beveled **OR** Square **OR** Round **OR** Manufacturer's standard edge detail, **as directed**.
5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** 3/4 inch (19 mm) deep **OR** Not less than 1 to 1-1/2 inches (25 to 38 mm) deep **OR** 15 mm deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Electroplated finish selected from manufacturer's full range, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. LR: Not less than 0.70 **OR** 0.75, **as directed**.
12. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
13. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

E. Stainless-Steel Pans And Suspension System For Linear Metal Ceiling
1. Stainless-Steel Pans and Suspension System:
2. Classification: Units complying with ASTM E 1264 for Type XIII, stainless-steel strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, stainless-steel strips with

mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated stainless-steel strips with sound-absorbent fabric backing, **as directed**.

3. Pan Thickness: Not less than 0.016 inch (0.396 mm) **OR** 0.019 inch (0.475 mm), **as directed**.
4. Pan Edge Detail: Manufacturer's standard edge detail, **as directed**.
5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
12. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

F. Accessories
1. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

G. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes
1. Mill Finish: AA-M10C10.
2. Lacquered Mill Finish: AA-M10C10R1x with manufacturer's standard clear, organic coating.
3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
5. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
6. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

I. Galvanized-Steel Sheet Finishes

1. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

J. Steel Sheet Finishes
1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

K. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation
1. Comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
   a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
   e. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   f. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   g. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   h. Do not attach hangers to steel deck tabs.
   i. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   j. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

k. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
   a. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   b. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
6. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
7. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
   a. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
   b. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
   c. Install pans with butt joints using internal pan splices.
      1) Joint Configuration: Aligned **OR** Aligned, every other panel length **OR** Staggered a minimum of 12 inches (300 mm) **OR** Random **OR** As indicated**, as directed**.
   d. Install directionally textured metal pans in directions indicated.
   e. Where metal pan ends are visible, install end caps unless trim is indicated.
   f. Install filler strips where indicated.
   g. Install sound-absorbent fabric layers in perforated metal pans.
   h. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.
8. Install hold-down clips where indicated.

B. Cleaning
1. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 54 23 00a

SECTION 09 63 13 00 - BRICK FLOORING

1.1 GENERAL

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

B. Summary
1. This Section includes the following:
a. Brick flooring set on thickset mortar bed.
b. Brick flooring set in thin-set mortar directly on concrete.

C. PRECONSTRUCTION TESTING
1. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, samples of flooring materials that will contact or affect mortar and grout that contain latex additives.
a. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed brick and other materials constituting brick flooring installation.

D. Submittals
1. Product Data: For each material indicated, except water and aggregates.
2. Samples: For each type of brick and grout indicated.

E. Delivery, Storage, And Handling
1. Store brick on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
2. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
4. Store liquids in tightly closed containers protected from freezing.

F. Project Conditions
1. Environmental Limitations: Do not use mortar and grout containing portland cement when temperature of brick, substrates, or materials is below 40 deg F (4.4 deg C).

1.2 PRODUCTS

A. Brick Pavers
1. Brick Pavers: Light-traffic paving brick; ASTM C 902, without frogs or cores in surfaces exposed to view in the completed Work.
a. Class SX for exposure to freezing weather, and Class MX for exterior uses that do not expose brick to freezing. Class NX for interior locations.
b. Type I for driveways and entrances to public and commercial buildings exposed to extensive abrasion; Type II, exterior walkways and floors in restaurants and stores exposed to intermediate traffic; Type III, floors and patios exposed to low traffic, as in single-family homes.
c. Application PS is normal tolerance for mortared joint installation; Application PX is close tolerance for ungrouted joints; Application PA is nonuniform sized for decorative effect.

2. Colors and Textures: As selected from manufacturer's full range.
3. Slip Resistance: Static coefficient of friction of at least 0.6 where used on level surfaces and 0.8 where used on ramps when tested according to ASTM C 1028.
4. Temporary Protective Coating: Precoat exposed surfaces of brick pavers at factory with a temporary protective coating that is compatible with brick, mortar, and grout products.

B. Mortar Setting-Bed Materials
1. Portland Cement: ASTM C 150, Type I or II.
2. Hydrated Lime: ASTM C 207, Type S.
3. Aggregate: ASTM C 144.
4. Latex Additive: Acrylic resin or styrene-butadiene-rubber, as recommended by manufacturer water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
5. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick, for work over wood subfloor or for isolation of portland cement setting bed from concrete subfloor.
6. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; ASTM A 1064, for portland cement setting beds over cleavage membrane.
7. Thin-Set Mortar: Latex-portland cement mortar complying with ANSI A118.4.
   a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
   b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
   c. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).

C. Grout Materials
1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
   a. Colored Mortar Pigments for Grout: Natural and synthetic iron and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved, through testing and experience, to be satisfactory for use in portland cement grout.
2. Standard Cement Grout: ANSI A118.6, sanded.
3. Polymer-Modified Tile Grout: ANSI A118.7, sanded.
4. Polymer Type: Ethylene vinyl acetate or acrylic additive; in dry, redispersible form; prepackaged with other dry ingredients.
5. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
6. Colors: As selected from manufacturer's full range.
7. Water: Potable.

D. Miscellaneous Materials
1. Expansion- and Control-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.
2. Sealer: Acrylic-based, slip-resistant, water-emulsion floor finish complying with ASTM D 4078 and specifically recommended by sealer manufacturer for use indicated.
3. Floor Wax: Formulated for use over sealer indicated, acceptable to sealer manufacturer, and specifically recommended by floor-wax manufacturer for use intended.
   a. Slip Resistance: Static coefficient of friction of at least 0.5 when tested according to ASTM D 2047.

E. Mixes
1. General: Comply with referenced standards and with manufacturers' written instructions. Discard mortars and grout when they have reached their initial set.

2. Portland Cement-Lime Setting-Bed Mortar: Type S **OR** N, **as directed,** complying with ASTM C 270, Proportion Specification, .
3. Latex-Portland Cement Mortar: Comply with written instructions of latex-additive manufacturer to produce stiff mixture with a moist surface when bed is ready to receive brick.
4. Mortar Bed Bond Coat: Mix neat cement and latex additive **OR** water, **as directed,** to a creamy consistency.
5. Latex-Portland Cement Slurry Bond Coat: Mix portland cement, aggregate, and latex additive to comply with written instructions of latex-additive manufacturer.
6. Thin-Set Mortar: Proportion and mix per written instructions of manufacturer.
7. Job-Mixed Portland Cement Grout: Proportion and mix to match setting-bed mortar, except omit hydrated lime and use enough water to produce a pourable mixture.
8. Job-Mixed Polymer-Modified Portland Cement Grout: Add liquid-latex additive to dry grout mix in proportion and concentration recommended by liquid-latex manufacturer. Proportion cement and aggregate to comply with directions of latex-additive manufacturer.
9. Packaged Grout Mix: Proportion and mix ingredients according to manufacturer's written instructions.

1.3 EXECUTION

A. Installation, General
1. Remove substances, from subfloor, that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
2. Mix bricks from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
3. Cut bricks with motor-driven masonry saw to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.
4. Joint Pattern: Running bond **OR** Herringbone **OR** Basket weave **OR** As indicated **OR** Match existing brick flooring joint pattern, **as directed**.
   a. Spaced Joint Widths: Provide nominal 3/8-inch (10-mm) **OR** 1/2-inch (13-mm), **as directed**, joint width with variations not exceeding plus or minus 1/16 inch (1.6 mm) **OR** 1/8 inch (3 mm), **as directed**.
5. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope.
6. Expansion and Control Joints: Provide joint filler as backing for sealant-filled joints where indicated. Install joint filler before setting brick flooring.

B. Thickset Mortared Brick Flooring
1. Apply mortar bed to concrete subfloors as follows:
   a. Saturate concrete subfloor with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
   b. Apply mortar bed bond coat over surface of concrete subfloor before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat.
   c. Apply mortar bed over bond coat immediately after applying bond coat. Spread and screed to elevations required for accurate setting of brick to finished elevations indicated.
   d. Brick Wet Set on Workable Mortar Bed: Mix and place only that amount of mortar bed that can be covered with brick before initial set. Cut back, bevel edge, and discard material that has reached initial set before placing brick.
   e. Brick Set on Cured Mortar Bed: Cure mortar bed for not less than 20 hours at 70 deg F (21 deg C).
2. Apply mortar bed over cleavage membrane as follows:
   a. Place cleavage membrane over subfloor, lapped at least 4 inches (100 mm) at joints.
   b. Place reinforcing wire fabric over membrane, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of setting bed. Hold edges back from vertical surfaces approximately 1/2 inch (13 mm).

c. Place mortar bed over cleavage membrane with reinforcing wire fabric fully embedded in middle of setting bed. Spread and screed to uniform thickness at elevations required for accurate setting of brick to finished elevations indicated.
d. Brick Wet Set on Workable Mortar Bed: Mix and place only that amount of mortar bed that can be covered with brick before initial set. Cut back, bevel edge, and discard material that has reached initial set before placing brick.
e. Brick Set on Cured Mortar Bed: Cure mortar bed for not less than 20 hours at 70 deg F (21 deg C).

3. Install brick either in workable mortar bed or in thin-set mortar bond coat over cured mortar bed at Contractor's option.
4. Install brick in workable mortar bed as follows:
   a. Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow brick to absorb the water so it is damp but not wet at the time of laying.
   b. Place brick before initial set of cement occurs. Immediately before placing brick, apply uniform 1/16-inch- (1.6-mm-) thick, slurry bond coat to bed or to back of each brick.
   c. Tamp or beat brick with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each brick in a single operation before initial set of mortar; do not return to areas already set and disturb bricks for purposes of realigning finished surfaces or adjusting joints.
5. Install brick in thin-set mortar bond coat over cured mortar bed as follows:
   a. Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow brick to absorb the water so it is damp but not wet at the time of laying.
   b. Apply thin-set mortar bond coat to setting bed with notched trowel complying with admixture manufacturer's specifications. Key the mortar into setting bed with flat side of trowel and comb with notched side of trowel in one direction. Apply only as much mortar as can be covered with brick before initial set (15 to 30 minutes).
   c. Place brick while bond coat is still tacky and before initial set takes place. Immediately before placing on setting bed, apply skim coat of thin-set mortar to back of brick. Place brick by sliding in a direction perpendicular to combed ridges and tamp or beat brick to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances.

C. Thin-Set Mortared Brick Flooring
1. Install brick flooring with thin-set mortar on concrete subfloor to comply with the following:
   a. Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow brick to absorb the water so it is damp but not wet at the time of laying.
   b. Apply thin-set mortar to substrate with notched trowel complying with admixture manufacturer's specifications for notch depth and configuration and in heavy enough layer to provide a minimum mortar-bed thickness of 3/32 to 1/8 inch (2.5 to 3 mm) after bricks are fully embedded. Key the mortar into substrate with flat side of trowel and comb with notched side of trowel in one direction. Apply only as much mortar as can be covered with brick before initial set (15 to 30 minutes).
   c. Place brick while mortar is still tacky and before initial set takes place. Immediately before placing brick, apply skim coat of thin-set mortar to back of brick. Place brick by sliding in a direction perpendicular to combed ridges and tamp or beat brick with a small beating block to obtain full contact with mortar and to bring finished surfaces within indicated tolerances; do not return to areas already set and disturb bricks for purposes of realigning finished surfaces or adjusting joints.

D. Joint Treatment
1. Hand-Tight Joints: Sweep dry mixture of portland cement and sand into joints and then fog surface with water to set mixture.

2. Grouted Joints: Grout brick joints complying with ANSI A108.10.
   a. Grout joints as soon as possible after initial set of setting bed. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free from drying cracks.
   b. Damp cure grout for seven days, unless otherwise recommended by grout or latex-additive manufacturer.

E. Repair, Pointing, Cleaning, And Protection
1. Remove and replace brick that is loose, chipped, broken, stained, or otherwise damaged or that does not match adjoining brick as intended. Provide new brick to match adjoining brick and install in same manner as original brick, with same joint treatment and with no evidence of replacement.
2. Pointing: During tooling of joints, enlarge voids or holes and completely fill with mortar or grout. Point up joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
3. Remove protective coating as recommended by protective coating manufacturer and acceptable to brick and grout manufacturers. Trap and remove coating to prevent it from clogging drains.
4. Sealing and Waxing: After floor has been cleaned and is thoroughly dry, seal and wax. Apply sealer and wax to comply with written directions of manufacturer of each product.

END OF SECTION 09 63 13 00

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Task	Specification	Specification Description
09 63 43 00	09 67 16 00	Resinous Flooring

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SECTION 09 64 00 00 - WOOD FLOORING

1.1 GENERAL

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

B. Summary
1. This Section includes:
a. Factory-finished wood flooring.
b. Field-finished wood flooring.
c. Sound control underlayment

C. Action Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 4: For recycled-rubber underlayment, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
b. Certificates for Credit MR 6 OR Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
c. Product Data for Credit IEQ 4.1: For wood flooring installation adhesives, documentation including printed statement of VOC content.
d. Product Data for Credit IEQ 4.2: For field-applied finishes for wood flooring, documentation including printed statement of VOC content.
e. Product Data for Credit IEQ 4.3: For wood flooring installation adhesives and field-applied finishes for wood flooring, documentation including printed statement of VOC content.
f. Product Data for Credit IEQ 4.3: For wood flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
g. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that the bonding agent contains no urea formaldehyde.
h. Laboratory Test Reports for Credit IEQ 4: For adhesives, field-applied finishes, flooring system elements, composite wood products and wood flooring systems.
3. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include expansion provisions and trim details.
4. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.
5. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

D. Maintenance Material Submittals
1. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
a. Wood Flooring: Equal to 1 percent of amount installed for each type of wood flooring indicated.

E. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.
   a. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.
3. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
   a. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
4. Softwood Flooring: Comply with WCLIB No. 17 grading rules for species, grade, and cut.

F. Delivery, Storage, And Handling
1. Deliver wood flooring materials in unopened cartons or bundles.
2. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
3. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

G. Project Conditions
1. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
   a. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
   b. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
      1) Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
      2) Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
2. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
3. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Field-Finished Wood Flooring
1. Certified Wood: Provide wood flooring produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Solid-Wood Plank Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled (kerfed) for stress relief.
   a. Species and Grade: Select red oak **OR** No. 1 Common red oak **OR** No. 2 Common red oak **OR** MFMA-RL First Grade hard maple **OR** MFMA-RL Second and Better Grade hard maple **OR** C & BTR - Flooring Douglas fir **OR** D - Flooring Douglas fir, **as directed**.
   b. Cut: Plain sawn **OR** Quarter/rift sawn **OR** Edge grain **OR** Vertical grain, **as directed**.
   c. Thickness: 3/4 inch (19 mm) **OR** 25/32 inch (20 mm), **as directed**.
   d. Face Width: 2-1/4 inches (57 mm) **OR** 3-1/8 inches (79 mm) **OR** 5-1/8 inches (130 mm), **as directed**.
   e. Lengths: Manufacturer's Standard **OR** Random-length strips complying with applicable grading rules **OR** Lengths required to form pattern indicated, **as directed**.
   f. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.

g. Simulated Wood Pegs: Contrasting wood pegs at ends of plank flooring pieces.

3. Solid-Wood Parquet Flooring: Kiln dried to 6 to 9 percent maximum moisture content.
   a. Species: Red oak **OR** White oak **OR** Ash **OR** Maple **OR** Black cherry, **as directed**.
   b. Thickness: 5/16 inch (8 mm) **OR** 11/16 inch (17 mm) **OR** 1/4 inch (6 mm), **as directed**.
4. Engineered-Wood Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.
   a. Species: Red oak **OR** White oak **OR** Ash **OR** Beech **OR** Maple **OR** Black cherry, **as directed**.
   b. Thickness: 1/2 inch (13 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
   c. Construction: Five **OR** Three, **as directed**, ply.
   d. Width: 2-1/4 inches (57 mm) **OR** 3 inches (76 mm), **as directed**.
   e. Length: Manufacturer's standard.
5. Urethane Finish System: Complete solvent-based, oil-modified **OR** water-based, **as directed**, system of compatible components that is recommended by finish manufacturer for application indicated.
   a. VOC Content: When calculated according to 40 CFR 59, Subpart D (EPA Method 24), as follows:
      1) Finish Coats and Floor Sealers: Not more than 350 g/L.
      2) Stains: Not more than 250 g/L.
   b. Finish Coats: Formulated for multicoat application on wood flooring.
   c. Stain: Penetrating and nonfading type.
      1) Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.
   d. Floor Sealer: Pliable, penetrating type.
   e. Finish Coats: Formulated for multicoat application on wood flooring.
6. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

B. Factory-Finished Wood Flooring
1. Certified Wood: Provide wood flooring produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content; tongue and groove and end matched; and with backs channeled (kerfed) for stress relief.
   a. Species: Red oak **OR** White oak **OR** Ash **OR** Birch **OR** Maple **OR** Black cherry **OR** Hickory **OR** Walnut, **as directed**.
   b. Cut: Plain sawn **OR** Quarter/rift sawn **OR** Edge grain **OR** Vertical grain, **as directed**.
   c. Thickness: 3/4 inch (19 mm) **OR** 25/32 inch (20 mm), **as directed**.
   d. Face Width: 2-1/4 inches (57 mm) **OR** 3-1/8 inches (79 mm) **OR** 5-1/8 inches (130 mm), **as directed**.
   e. Lengths: Random-length strips complying with applicable grading rules **OR** Lengths required to form pattern indicated, **as directed**.
   f. Edge Style: Square **OR** Beveled (eased), **as directed**.
   g. Finish: UV urethane system.
      1) Color: As selected from manufacturer's full range, **as directed**.
3. Solid-Wood Parquet Flooring: Kiln dried to 6 to 9 percent maximum moisture content.
   a. Species: Red oak.
   b. Thickness: 5/16 inch (8 mm) **OR** 11/16 inch (17 mm) **OR** 1/4 inch (6 mm), **as directed**.
   c. Finish: UV urethane **OR** Acrylic impregnated, **as directed**.
      1) Color: As selected from manufacturer's full range.
4. Engineered-Wood Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.
   a. Species: Red oak **OR** White oak **OR** Ash **OR** Beech **OR** Birch **OR** Maple **OR** Black cherry **OR** Hickory **OR** Walnut, **as directed**.
   b. Thickness: 1/2 inch (13 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
   c. Construction: Five **OR** Three ply, **as directed**.
   d. Width: 2-1/4 inches (57 mm) **OR** 3 inches (76 mm), **as directed**.
   e. Length: Manufacturer's standard.

f. Edge Style: Square **OR** Beveled (eased), **as directed**.
g. Finish: UV urethane **OR** Acrylic impregnated, **as directed**.
1) Color: As selected in manufacturer's full range.

5. Engineered-Wood Parquet Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.
a. Species: Red oak **OR** Ash **OR** Beech **OR** Maple **OR** Walnut, **as directed**.
b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**.
c. Construction: Five **OR** Three, **as directed**, ply.
d. Finish: UV urethane.
1) Color: As selected from manufacturer's full range.

C. Sound Control Underlayment
1. Sound Control Underlayment: Sound reducing underlayment consisting of impact-absorbing materials. Minimum Impact Insulation Class (IIC) of 50 **OR** 55, as directed when tested according to ASTM E 492.
2. Material: Recycled rubber **OR** Polyurethane foam **OR** Wood fiber **OR** Wood fiber made with binder containing no urea formaldehyde, as directed.
3. Thickness: 3/4 inch (19 mm) **OR** 1/2 inch (13 mm) **OR** 3/8 inch (9 mm) **OR** 1/4 inch (6 mm) **OR** 5/32 inch (4 mm), as directed.

D. Accessory Materials
1. Wood Underlayment: As specified in Division 06 Section "Rough Carpentry".
2. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) **OR** 8.0 mils (0.2 mm) thick, **as directed**,.
3. Asphalt-Saturated Felt: ASTM D 4869, Type II.
4. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
a. Use adhesives that have a VOC content of not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
6. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."
7. Thresholds and Saddles: To match wood flooring. Tapered on each side.
8. Reducer Strips: To match wood flooring. 2 inches (51 mm) wide, tapered, and in thickness required to match height of flooring.
9. Cork Expansion Strip: Composition cork strip.
10. Feature Strips: 2-inch- (51-mm-) wide, square-edged walnut strips furnished in lengths as long as practical and in thickness to match wood flooring.
11. Metal Feature Strips: 1/8-by-1/8-inch (3-by-3-mm) solid-brass strip, designed for inlaying into routed reveal in wood flooring surface.
12. Wood air vents and grilles of same species and grade as wood flooring and in sizes indicated on Drawings.

1.3 EXECUTION

A. Examination
1. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

a. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
   1) Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
      a) Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) **OR** 4.5 lb of water/1000 sq. ft. (2.04 kg of water/92.9 sq. m), as directed in 24 hours.
   2) Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

B. Preparation
1. Concrete Slabs: Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
   a. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
2. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Installation
1. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
2. Wood Sleepers and Subfloor: Install according to requirements in Division 06 Section "Rough Carpentry".
3. Wood Underlayment: Install according to requirements in Division 06 Section "Rough Carpentry".
4. Provide expansion space at walls and other obstructions and terminations of flooring as indicated on Drawings **OR** of not less than 3/4 inch (19 mm), **as directed**.
5. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:
   a. Wood Flooring Nailed to Sleepers over Concrete: Install flooring over a layer of polyethylene sheet with edges overlapped over sleepers and turned up behind baseboards.
   b. Wood Flooring Nailed to Sleepers over Concrete: Install flooring over a layer of polyethylene sheet with edges overlapped over sleepers and turned up behind baseboards.
   c. Wood Flooring Installed Directly on Concrete: Install a layer of polyethylene sheet according to flooring manufacturer's written instructions.
6. Sound Control Underlayment: Install over vapor retarder in accordance with manufacturer's written instructions.
7. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
   a. For flooring of face width more than 3 inches (75 mm), do the following:
      1) Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.
      2) Install no fewer than 2 countersunk nails at each end of each piece, spaced not more than 16 inches (406 mm) along length of each piece, in addition to blind nailing. Fill holes with matching wood filler.
8. Solid-Wood Parquet Flooring: Set in adhesive.
9. Engineered-Wood Flooring: Set in adhesive **OR** Nail or staple **OR** Install floating floor, **as directed**.

D. Field Finishing

1. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
   a. Comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
2. Fill open-grained hardwood.
3. Fill and repair wood flooring seams and defects.
4. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
   a. Apply stains to achieve an even color distribution matching approved Samples.
   b. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
5. Cover wood flooring before finishing.
6. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

E. Protection
1. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
   a. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 64 00 00

Task	Specification	Specification Description
09 64 13 00	09 64 00 00	Wood Flooring

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SECTION 09 64 23 00 - WOOD SPORTS-FLOOR ASSEMBLIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for wood sports-floor assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes wood sports-floor assemblies.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:
   a. Expansion provisions and trim details.
   b. Layout, colors, widths, and dimensions of game lines and markers.
   c. Locations of floor inserts for athletic equipment installed through flooring assembly.
3. Samples: For each exposed finish.
4. LEED Submittals:
   a. Product Data for Credit EQ 4.1: For wood sports-floor assembly installation adhesives, including printed statement of VOC content.
   b. Product Data for Credit EQ 4.2: For field-applied finishes and game-line and marker paints, including printed statement of VOC content.
   c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood flooring complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
      1) Include statement indicating costs for each certified wood product.
5. Maintenance data.

D. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Responsibilities: Include installation and field finishing of sports-floor assembly components and accessories, and application of game lines and markers.
3. Forest Certification: Provide wood components produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
   a. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

E. Delivery, Storage, And Handling
1. Deliver assembly materials in unopened cartons or bundles.
2. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
3. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

F. Field Conditions
1. Conditioning period begins not less than seven days before sports-floor assembly installation, is continuous through installation, and continues not less than seven days after sports-floor installation.

a. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive sports-floor assemblies during the conditioning period.
b. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
   1) Do not install sports-floor assemblies until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
   2) Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.
c. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
d. Install sports-floor assemblies after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Description
1. System Type: Floating **OR** Fixed **OR** Anchored resilient **OR** Portable, as directed.
2. Overall System Height: 2-1/8 inches (54 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm), **as directed.**

B. Performance
1. Provide wood athletic flooring systems tested by a qualified testing agency according to DIN V 18032-2 and shown to meet the following requirements:
   a. Shock Absorption: Minimum 53 percent.
   b. Vertical Deflection: Minimum 0.09 inch (2.3 mm).
   c. Area of Deflection: Maximum 15 percent.
   d. Ball Bounce: Minimum **90** percent.
   e. Surface Friction: Not less than 0.5 or more than 0.7.
   f. Rolling Loads: No damage when subjected to 337 lbf (1500 N) applied through a single wheel.

C. Flooring Material
1. Random-Length Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.
   a. Grade: MFMA-RL First **OR** Second and Better **OR** Third and Better, **as directed**.
      1) Exception: For areas under stacked portion of telescoping bleachers that are normally concealed from view, provide Third and Better Grade.
   b. Cut: Edge **OR** Flat, **as directed**.
   c. Thickness: 25/32 inch (20 mm) **OR** 33/32 inch (26 mm), **as directed**.
   d. Face Width: 2-1/4 inches (57 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
2. Finger-Jointed Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.
   a. Grade: MFMA-RL First **OR** Second and Better **OR** Third and Better, **as directed**.
      1) Exception: For areas under stacked portion of telescoping bleachers that are normally concealed from view, provide Third and Better Grade.
   b. Cut: Edge **OR** Flat, **as directed**.
   c. Thickness: 25/32 inch (20 mm) **OR** 33/32 inch (26 mm), **as directed**.
   d. Face Width: 2-1/4 inches (57 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
3. Parquet Flooring: Northern hard maple (Acer saccharum), kiln dried, edge grain, and square edge.
   a. Grade: MFMA-PQ Second and Better **OR** Third and Better, **as directed**.

b. Thickness: Not less than 5/16 inch (8 mm) **OR** 3/8 inch (10 mm) **OR** 7/16 inch (11 mm) **OR** 1/2 inch (13 mm) **OR** 11/16 inch (17 mm), **as directed**.
c. Picket Dimensions:
1) Width: 7/8 inch (22 mm) or 1-1/8 inches (29 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/8 inches (29 mm), **as directed**.
2) Length: 6 inches (152 mm) **OR** 9 inches (229 mm), **as directed**.

D. Subfloor Materials
1. Board Underlayment: Nominal 1-by-6-inch (25-by-150-mm) graded boards; of SPIB No. 2 Southern pine, WCLIB Construction grade (any species), or WWPA No. 3 (any species), dried to 15 percent moisture content.
2. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 15/32 inch (12 mm) **OR** 23/32 inch (18 mm), **as directed**, thick.
3. Wood Sleepers: Standard grade; 48 inches (1200 mm) long; kiln-dried Eastern hemlock, fir, pine, or spruce.
a. Size: Nominal 2 by 3 inches (50 by 75 mm) **OR** 2 by 4 inches (50 by 100 mm), **as directed**.
b. Sleeper Anchors: Manufacturer's standard, but not less than steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf (4000-N) pullout strength.
c. Sleeper Shims: In size and type recommended in writing by flooring manufacturer for application indicated.
d. Asphalt Primer: ASTM D 41.
e. Asphalt Mastic: ASTM D 312, Type I, cold-applied dead-level asphalt or Type III, hot-applied steep asphalt, as recommended in writing by manufacturer.
4. Channels: Manufacturer's standard as indicated by product designation above.
a. Channel Anchors: Manufacturer's standard but not less than modified steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf (4000-N) pullout strength.
b. Clips: Manufacturer's standard as indicated by product designation above.
5. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
a. Material: PVC **OR** Rubber **OR** Neoprene, **as directed**.
b. Thickness: 3/8 inch (10 mm) **OR** 7/16 inch (11 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
6. Resilient Underlayment: Flexible, multicellular, closed-cell, expanded polyethylene-foam sheet; 1/2 inch (13 mm) thick; nominal 2-lb/cu. ft. (32-kg/cu. m) density, **as directed**.

E. Finishes
1. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer, and MFMA approved.
a. Floor-Sealer Formulation: Pliable, penetrating type. MFMA Group 1, Sealers.
b. Finish-Coat Formulation: Formulated for gloss finish indicated and multicoat application.
1) Type: MFMA Group 3, Gymnasium-Type Surface Finishes **OR** MFMA Group 5, Water-Based Finishes, **as directed.**
c. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
d. VOC Content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1) Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
2) Game-Line and Marker Paint: VOC content of not more than 150 g/L.
e. VOC Emissions: Provide products that comply with the maximum allowable concentrations of VOCs when tested according to California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Accessories
1. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils (0.15 mm) thick.
2. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches (100 by 75 by 1200 mm); with premolded outside corners.
   a. Color: Black **OR** Brown, **as directed**.
3. Wood Wall Base: Nominal 1-by-3-inch (25-by-75-mm) wood base **OR** Built-up wood base as indicated on Drawings, **as directed**, matching species, grade, and cut of wood flooring.
4. Thresholds: As specified in Division 08 Section "Door Hardware".
5. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
6. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.
7. Adhesives: Manufacturer's standard for application indicated.
   a. Concrete Primers: Manufacturer's standard for application indicated.
   b. Use adhesive and primer, if any, that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
   a. Type: MFMA Group 3, Gymnasium Type (Surface) Finishes; urethane-oil type **OR** Group 5, Water Based Finishes; polyurethane, **as directed**.
   b. Floor-Sealer Formulation: Pliable, penetrating type.
   c. Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
   d. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
   e. VOC content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      1) Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
      2) Game-Line and Marker Paint: VOC content of not more than 150 g/L.

1.3 EXECUTION

A. Preparation
1. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
   a. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
2. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.
3. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
1. General: Comply with sports-floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
2. Pattern: Lay flooring parallel with long dimension of space to be floored, unless otherwise indicated.
3. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
   a. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
4. Vapor Retarder: Install with joints lapped a minimum of 6 inches (150 mm) and sealed.

5. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.
6. Sleepers:
   a. Install perpendicular to direction of flooring, staggering end joints a minimum of 24 inches (610 mm).
   b. Space at spacing recommended by manufacturer for system components indicated **OR** 12 inches (305 mm) o.c. **OR** 9 inches (229 mm) o.c. **OR** 8 inches (203 mm) o.c., **as directed**.
   c. Shim and level sleepers and install anchors at spacing recommended by manufacturer, but not less than 30 inches (760 mm) o.c.
   d. Anchor predrilled sleepers through resilient pads.
7. Channels: Anchor channels to substrate according to manufacturer's written instructions.
   a. Install wood strip flooring across channels.
   b. Insert steel clip at each intersection of a flooring strip with a channel.
8. Strip Flooring: Mechanically fasten perpendicular to supports.
9. Parquet Flooring: Adhere to substrates according to manufacturer's written instructions.
10. Installation Tolerances: 1/8 inch in 10 feet (3 mm in 3 m) of variance from level.

C. Sanding And Finishing
1. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."
2. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.
3. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.
4. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
   a. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
   b. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
      1) Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
      2) Where game lines cross, break minor game line at intersection; do not overlap lines.
      3) Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
      4) Apply finish coats after game-line and marker paint is fully cured.

D. Protection
1. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Final Completion.
   a. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
   b. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.

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Task	Specification	Specification Description
09 64 23 00	09 64 00 00	Wood Flooring
09 64 29 00	09 64 00 00	Wood Flooring
09 64 29 00	09 64 23 00	Wood Sports-Floor Assemblies
09 64 66 00	09 64 00 00	Wood Flooring
09 64 66 00	09 64 23 00	Wood Sports-Floor Assemblies

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SECTION 09 65 13 13 - CORK FLOORING

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Cork floor tile.
b. Engineered cork floor tile.
c. Cork rubber floor tile.
d. Cork floating floor system.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 6.0: For cork flooring, including printed statement of costs for each rapidly renewable material.
b. Product Data for Credit EQ 4.1: For adhesive, including printed statement of VOC content.
c. Product Data for Credit EQ 4.2: For field-applied sealer and finish coatings, including printed statement of VOC content.
d. Product Data for Credit EQ 4.4: For cork flooring and MDF, including printed statement indicating that the bonding agent and adhesive contain no urea-formaldehyde resins.
3. Shop Drawings: For each type of cork flooring. Include cork flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
4. Samples: Full-size units of each shade and finish **OR** shade, pattern, and finish **OR** color and pattern, **as directed**, of cork flooring required.
5. Maintenance Data: For each type of cork flooring to include in maintenance manuals.

D. Quality Assurance
1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm **OR** Class II, not less than 0.22 W/sq. cm, **as directed**.
2. Product Certificates: For cork floating floor system, from manufacturer, certifying that MDF core contains no urea-formaldehyde resins.

E. Delivery, Storage, And Handling
1. Store cork flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store cork flooring on flat surfaces.

F. Project Conditions
1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C) where relative humidity is between 45 and 65 percent, in spaces to receive cork flooring during the following time periods:
a. 72 hours before installation.
b. During installation.
c. 72 hours after installation.

2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C).
3. Close spaces to traffic during cork flooring installation.
4. Close spaces to traffic for 72 hours after cork flooring installation.
5. Install cork flooring after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Cork Floor Tile
1. Cork Floor Tile: Composed of 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Minimum Density: 30 lb/cu. ft. (480 kg/cu. m) **OR** 34 lb/cu. ft. (544 kg/cu. m) **OR** 37 lb/cu. ft. (592 kg/cu. m), **as directed**.
4. Thickness: Nominal 0.180 inch (4.8 mm) **OR** Nominal 0.312 inch (8.0 mm), **as directed**.
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

B. Engineered Cork Floor Tile
1. Engineered Cork Floor Tile: Composed of 100 percent natural cork bark and recycled cork granules with laminated, patterned cork veneers and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Minimum Density: 30 lb/cu. ft. (480 kg/cu. m) **OR** 34 lb/cu. ft. (544 kg/cu. m) **OR** 37 lb/cu. ft. (592 kg/cu. m), **as directed**.
4. Thickness: Nominal 0.180 inch (4.8 mm) **OR** Nominal 0.312 inch (8.0 mm), **as directed**.
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Pattern: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
8. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

C. Cork Rubber Floor Tile
1. Cork Rubber Floor Tile: Composed of 70 percent natural cork granules and 30 percent rubber granules combined with fade-resistant pigments; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork rubber floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Physical Characteristics:
   a. Minimum Density: 78 lb/cu. ft. (1249 kg/cu. m).
   b. Minimum Tensile Strength: 700 psi (4.8 MPa).
4. Thickness: Nominal 0.125 inch (3.2 mm).
5. Size: 18 by 18 inches (450 by 450 mm).

6. Texture: Lightly textured wear surface.
7. Colors and Patterns: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from full range of industry colors, **as directed**.

D. Cork Floating Floor System
1. Cork Floating Floor System: Laminated planks made of two cork layers, top and bottom, sandwiched around an MDF core and containing no urea-formaldehyde resins.
2. Plank Density:
   a. Cork Top Layer: 28 lb/cu. ft. (448 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
   b. Interlocking MDF Core: 45 lb/cu. ft. (720 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
   c. Cork Underlayment Layer: 13 lb/cu. ft. (208 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
3. Plank Thickness: Nominal 0.450-inch (11.4-mm) overall thickness made up as follows:
   a. Cork Top Layer: Nominal 0.125 inch (3.2 mm) **OR** Manufacturer's standard dimension, **as directed**.
   b. Interlocking MDF Core: Nominal 0.250 inch (6.3 mm) **OR** Manufacturer's standard dimension, **as directed**.
   c. Cork Underlayment Layer: Nominal 0.078 inch (2.0 mm) **OR** Manufacturer's standard dimension, **as directed**.
4. Plank Size: 18 by 18 inches (450 by 450 mm) **OR** 36 by 12 inches (900 by 305 mm), **as directed**.
5. Plank Edge: Tongue-and-groove type **OR** Manufacturer's standard interlock, **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Pattern: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
8. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

E. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement-based or blended hydraulic-cement-based formulation provided or approved by cork flooring manufacturer for applications indicated.
2. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) **OR** 8.0 mils (0.2 mm), **as directed**, thick.
3. Adhesive: Water-resistant products as recommended by manufacturer to suit cork flooring and substrate conditions indicated.
   a. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Field-Applied Finishes
1. Cork Sealer: Product as recommended by cork flooring manufacturer.
   a. Use sealers that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Paste Wax: Products as recommended by cork flooring manufacturer.
3. Finish Coatings: Products containing UV inhibitors as recommended by cork flooring manufacturer.
   a. Use finish coatings that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Cork Rubber Tile Sealer: Product as recommended by cork rubber floor tile manufacturer.
   a. Use sealers that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Preparation
1. Prepare substrates according to cork flooring manufacturer's written instructions to ensure adhesion of cork flooring.
2. Concrete Substrates: Prepare according to ASTM F 710.
   a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   c. Alkalinity and Adhesion Testing: Perform tests recommended by cork flooring manufacturer. Proceed with installation only after substrates pass testing.
   d. Moisture Testing: Perform tests recommended by cork flooring manufacturer and as follows. Proceed with installation only after substrates pass testing.
      1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
3. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
4. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
5. Do not install cork flooring until materials are same temperature as space where they are to be installed.
   a. Move cork flooring products and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
6. Immediately before installation, sweep and vacuum clean substrates to be covered by cork flooring products.

B. Floor Tile Installation
1. Comply with cork flooring manufacturer's written instructions for installing cork flooring.
2. Mix floor tiles from each carton together to ensure uniform distribution of shade.
3. Discard broken, cracked, chipped, or deformed floor tiles.
4. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
5. Lay floor tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in ashlar or staggered joint pattern **OR** in pattern indicated, **as directed**.
6. Apply adhesive to substrate and set floor tiles in adhesive.
7. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
8. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
9. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
10. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of shade and finish **OR** shade, pattern, and finish **OR** color and pattern, **as directed**, between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

C. Cork Floating Floor System Installation

1. Comply with manufacturer's written instructions for installing cork floating floor system.
2. Install continuous vapor retarder over substrate, taping side and end laps.
3. Mix floor planks from several cartons to ensure uniform distribution of shade.
4. Discard broken, cracked, chipped, or deformed floor planks.
5. Do not attach floor planks to substrate.
6. Tightly interlock and adhere plank edges with adhesive. Remove excess adhesive from top surface of planks.
7. Lay floor planks in pattern indicated.
8. Use spacers to keep planks from shifting as subsequent rows are added. Remove spacers after installing cork floating floor system.
9. Maintain expansion space at walls and other obstructions and terminations of flooring as indicated on Drawings **OR** of not less than 3/8 inch (9.5 mm), **as directed**.
10. Extend floor planks into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.
11. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

D. Field-Applied Finishes
1. Apply finishes according to cork flooring manufacturer's written instructions.
2. Cork Sealer: Apply one **OR** two, **as directed**, coat(s).
3. Paste Wax: Apply one **OR** two **OR** three, **as directed**, coat(s).
4. Finish Coatings: Apply two **OR** three, **as directed**, coat(s).
5. Cork Rubber Tile Sealer: Apply one **OR** two, **as directed**, coat(s).

E. Cleaning And Protection
1. Comply with manufacturer's written instructions for cleaning and protecting cork flooring.
2. Remove adhesive and other blemishes from exposed surfaces.
3. Sweep and vacuum surfaces thoroughly.
4. Damp-mop surfaces to remove marks and soil.
5. Protect cork flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
6. Cover cork flooring until Final Completion.

END OF SECTION 09 65 13 13

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SECTION 09 65 13 13a - RESILIENT WALL BASE AND ACCESSORIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for resilient wall base and accessories. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Resilient base.
b. Resilient stair accessories.
c. Resilient molding accessories.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

D. Quality Assurance
1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling
1. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

F. Project Conditions
1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
a. 48 hours before installation.
b. During installation.
c. 48 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Install resilient products after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Resilient Base
1. Resilient Base Standard: ASTM F 1861.
a. Material Requirement: Type TV (vinyl, thermoplastic) **OR** Type TS (rubber, vulcanized thermoset) **OR** Type TP (rubber, thermoplastic), **as directed**.
b. Manufacturing Method: Group I (solid, homogeneous) **OR** Group II (layered), **as directed**.

c. Style: Cove (base with toe) **OR** Straight (flat or toeless) **OR** Butt to (fit-to-floor), **as directed**.

2. Minimum Thickness: 0.125 inch (3.2 mm) **OR** 0.080 inch (2.0 mm), **as directed**.
3. Height: 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
4. Lengths: Cut lengths, 48 inches (1219 mm) long **OR** Coils in manufacturer's standard length, **as directed**.
5. Outside Corners: Job formed **OR** Preformed, **as directed**.
6. Inside Corners: Job formed **OR** Preformed, **as directed**.
7. Finish: Satin **OR** Matte **OR** Low luster **OR** As selected from manufacturer's full range, **as directed**.
8. Colors and Patterns: As selected from full range of industry colors.

B. Resilient Stair Accessories

1. Resilient Stair Treads Standard: ASTM F 2169.
   a. Material Requirement: Type TV (vinyl, thermoplastic) **OR** Type TS (rubber, vulcanized thermoset) **OR** Type TP (rubber, thermoplastic), **as directed**.
   b. Surface Design:
      1) Class 1, Smooth (flat).
      2) Class 2, Pattern: Raised-disc design **OR** Raised-square design **OR** Raised-chevron design **OR** Raised-diamond design **OR** Raised-rib design **OR** Raised-rib design with abrasive strips, **as directed**.
   c. Manufacturing Method: Group 1, tread with embedded abrasive strips **OR** Group 2, tread with contrasting color for the visually impaired, **as directed**.
2. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees **OR** Square **OR** Round, **as directed**.
3. Nosing Height: 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 2-3/16 inches (56 mm), **as directed**.
4. Thickness: 1/4 inch (6 mm) and tapered to back edge.
5. Size: Lengths and depths to fit each stair tread in one piece **OR** one piece or, for treads exceeding maximum lengths manufactured, in equal-length units, **as directed**.
6. Risers: Smooth, flat, coved-toe, 7 inches (178 mm) high by length matching treads **OR** toeless, height and length to cover risers, **as directed**; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
   a. Thickness: 0.125 inch (3.2 mm) **OR** 0.080 inch (2.0 mm), **as directed**.
7. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
8. Colors and Patterns: As selected from full range of industry colors.

C. Resilient Molding Accessory

1. Description: Cap for cove carpet **OR** Cap for cove resilient floor covering **OR** Carpet bar for tackless installations **OR** Carpet edge for glue-down applications **OR** Nosing for carpet **OR** Nosing for resilient floor covering **OR** Reducer strip for resilient floor covering **OR** Joiner for tile and carpet **OR** Transition strips, **as directed**.
2. Material: Vinyl **OR** Rubber, **as directed**.
3. Profile and Dimensions: As indicated.
4. Colors and Patterns: As selected from full range of industry colors.

D. Installation Materials

1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

a. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1) Cove Base Adhesives: Not more than 50 g/L.
   2) Rubber Floor Adhesives: Not more than 60 g/L.

3. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
4. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
5. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

1.3 EXECUTION

A. Preparation
1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
2. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
   a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
   d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
4. Do not install resilient products until they are same temperature as the space where they are to be installed.
   a. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
5. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

B. Resilient Base Installation
1. Comply with manufacturer's written instructions for installing resilient base.
2. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
3. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
4. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
5. Do not stretch resilient base during installation.
6. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
7. Preformed Corners: Install preformed corners before installing straight pieces.
8. Job-Formed Corners:
   a. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

b. Inside Corners: Use straight pieces of maximum lengths possible.

C. Resilient Accessory Installation
1. Comply with manufacturer's written instructions for installing resilient accessories.
2. Resilient Stair Accessories:
   a. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
   b. Tightly adhere to substrates throughout length of each piece.
   c. For treads installed as separate, equal-length units, install to produce a flush joint between units.
3. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet **OR** resilient floor covering, **as directed**, that would otherwise be exposed.

D. Cleaning And Protection
1. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
2. Perform the following operations immediately after completing resilient product installation:
   a. Remove adhesive and other blemishes from exposed surfaces.
   b. Sweep and vacuum surfaces thoroughly.
   c. Damp-mop surfaces to remove marks and soil.
3. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
   a. Apply one **OR** two **OR** three, **as directed**, coat(s).
5. Cover resilient products until Final Completion.

END OF SECTION 09 65 13 13a

Task	Specification	Specification Description
09 65 13 23	09 65 13 13	Cork Flooring

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SECTION 09 65 13 33 - RESILIENT FLOOR TILE

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Solid vinyl floor tile.
b. Rubber floor tile.
c. Vinyl composition floor tile.
d. Resilient terrazzo floor tile.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit EQ 4.1: For adhesives, sealants and chemical-bonding compounds, including printed statement of VOC content.
3. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
a. Show details of special patterns.
4. Samples: Full-size units of each color and pattern of floor tile required.
5. Seam Samples: For seamless-installation technique indicated and for each flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
6. Maintenance data.

D. Quality Assurance
1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
2. Preconstruction Testing: Use manufacturer's standard test methods to determine whether materials will obtain optimum adhesion with installed flooring material.

E. Delivery, Storage, And Handling
1. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

F. Project Conditions
1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
a. 48 hours before installation.
b. During installation.
c. 48 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during floor tile installation.
4. Close spaces to traffic for 48 hours after floor tile installation.

5. Install floor tile after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Solid Vinyl Floor Tile
1. Tile Standard: ASTM F 1700.
   a. Class: As indicated by product designations **OR** Class I, monolithic vinyl tile **OR** Class II, surface-decorated vinyl tile **OR** Class III, printed film vinyl tile, **as directed**.
   b. Type: Type A, smooth surface **OR** Type B, embossed surface, **as directed**.
2. Thickness: 0.080 inch (2.0 mm) **OR** 0.100 inch (2.5 mm) **OR** 0.120 inch (3.0 mm) **OR** 0.125 inch (3.2 mm), **as directed**.
3. Size: 12 by 12 inches (305 by 305 mm) **OR** 18 by 18 inches (457 by 457 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 36 by 36 inches (914 by 914 mm) **OR** 3 by 36 inches (76 by 914 mm), **as directed**.
4. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
5. Colors and Patterns: As selected from full range of industry colors.

B. Rubber Floor Tile
1. Tile Standard: ASTM F 1344, Class I-A, homogeneous rubber tile, solid color **OR** Class I-B, homogeneous rubber tile, through mottled **OR** Class II-A, laminated rubber tile, solid-color wear layer **OR** Class II-B, laminated rubber tile, mottled wear layer, **as directed**.
2. Hardness: Not less than 85 as required by ASTM F 1344, measured using Shore, Type A durometer per ASTM D 2240 **OR** Manufacturer's standard hardness, **as directed**.
3. Wearing Surface: Smooth **OR** Textured **OR** Molded pattern, **as directed**.
   a. Molded-Pattern Figure: Raised discs **OR** Raised squares, **as directed**.
4. Thickness: 0.125 inch (3.2 mm).
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
7. Colors and Patterns: As selected from full range of industry colors.

C. Vinyl Composition Floor Tile
1. Tile Standard: ASTM F 1066, Class 1, solid-color tile **OR** Class 2, through-pattern tile **OR** Class 3, surface-pattern tile, **as directed**.
2. Wearing Surface: Smooth **OR** Embossed, **as directed**.
3. Thickness: 0.125 inch (3.2 mm).
4. Size: 12 by 12 inches (305 by 305 mm).
5. Colors and Patterns: As selected from full range of industry colors.

D. Resilient Terrazzo Floor Tile
1. Resilient Terrazzo Floor Tile: Marble or granite chips embedded in flexible, thermoset-polyester-resin matrix; electrically nonconductive and chemical, oil, and corrosion resistive, with smooth wearing surface and manufacturer's standard factory-applied, protective urethane coating.
2. Thickness: 1/8 inch (3.0 mm) **OR** 3/16 inch (4.8 mm), **as directed**.
3. Size: 12 by 12 inches (305 by 305 mm).
4. Performance Characteristics:
   a. Compressive Strength: 2900 to 5000 psi (20 to 34.5 MPa), ASTM C 109/C 109M or ASTM D 695.
   b. Abrasion Resistance: Maximum 0.0196 cubic centimeters volume loss, ASTM F 510, Taber abrader, S-39 wheels, at 500 cycles with 1000-gram load.
   c. Static Load Limit: 0.0007-inch (0.0177-mm) maximum indentation, ASTM F 970 at 125 lb (57 kg).
   d. Resin Matrix Hardness: Not less than 78, as measured using Shore, Type D durometer per ASTM D 2240.
5. Colors and Patterns: As selected from full range of industry colors.

E. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
   a. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      1) VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
      2) Rubber Floor Adhesives: Not more than 60 g/L.
3. Seamless-Installation Accessories:
   a. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
      1) Color: As selected from manufacturer's full range to contrast with floor tile **OR** Match floor tile, **as directed**.
   b. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
      1) Use chemical-bonding compound that has a VOC content of 350 **OR** 510, **as directed**, g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
5. Joint Sealant for Resilient Terrazzo Floor Tile: Silicone sealant of type and grade as recommended in writing by manufacturer to suit resilient terrazzo floor tile.
   a. Use sealant that has a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Joint-Sealant Color: White **OR** As selected from manufacturer's full range to match floor tile **OR** Match floor tile, **as directed**.
6. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Premium-type products as recommended by manufacturer for resilient terrazzo floor tile.

1.3 EXECUTION

A. Preparation
1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
2. Concrete Substrates: Prepare according to ASTM F 710.
   a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
3. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
4. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
5. Do not install floor tiles until they are same temperature as space where they are to be installed.
   a. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

6. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

B. Floor Tile Installation
1. Comply with manufacturer's written instructions for installing floor tile.
2. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   a. Lay tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in pattern indicated, **as directed**.
3. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   a. Lay tiles with grain running in one direction **OR** with grain direction alternating in adjacent tiles (basket-weave pattern) **OR** in pattern of colors and sizes indicated, **as directed**.
4. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
5. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
7. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
8. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
9. Seamless Installation:
   a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   b. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

C. Cleaning And Protection
1. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
2. Perform the following operations immediately after completing floor tile installation:
   a. Remove adhesive and other blemishes from exposed surfaces.
   b. Sweep and vacuum surfaces thoroughly.
   c. Damp-mop surfaces to remove marks and soil.
3. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   a. Apply one **OR** two **OR** three, **as directed**, coat(s).
5. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
6. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
   a. Sealer: Apply two base coats of liquid sealer.
   b. Finish: Apply two **OR** three, **as directed**, coats of liquid floor finish.

7. Cover floor tile until Final Completion.

END OF SECTION 09 65 13 33

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SECTION 09 65 13 33a - LINOLEUM FLOOR COVERINGS

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Linoleum floor tile **OR** sheet flooring, **as directed**.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 6.0: For linoleum flooring, including printed statement of costs for each rapidly renewable material.
b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
4. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections of each color and pattern of floor covering required.
a. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.
5. Heat-Welded Seam Samples: For each floor covering product and welding bead color and pattern combination required, with seam running lengthwise and in center of 6-by-9-inch (152-by-230-mm) Sample applied to rigid backing and prepared by Installer for this Project.
6. Maintenance data.

D. Quality Assurance
1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling
1. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).
a. Floor Tile: Store on flat surfaces.
b. Sheet Flooring: Store rolls upright.

F. Project Conditions
1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor coverings during the following time periods:
a. 72 hours before installation.
b. During installation.
c. 72 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during floor covering installation.

4. Close spaces to traffic for 72 hours after floor covering installation.
5. Install floor coverings after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Linoleum Floor Covering
1. Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing **OR** Type II, linoleum floor tile with special backing **OR** Type III, linoleum floor tile without backing, **as directed**.
   a. Nominal Floor Tile Size: Manufacturer's standard **OR** 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (460 by 460 mm) **OR** 20 by 20 inches (500 by 500 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**.
2. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing **OR** Type III, linoleum sheet with special backing, **as directed**.
   a. Roll Size: In manufacturer's standard length by not less than 78 inches (1980 mm) wide.
3. Seaming Method: Standard **OR** Heat welded, **as directed**.
4. Thickness: 0.08 inch (2.0 mm) **OR** 0.10 inch (2.5 mm) **OR** 0.13 inch (3.2 mm) **OR** 0.16 inch (4.0 mm) **OR** 0.18 inch (4.5 mm), **as directed**.
5. Colors and Patterns: As selected from full range of industry colors.

B. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.
   a. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Heat-Welding Bead: Solid-strand product of linoleum floor covering manufacturer.
   a. As selected from manufacturer's full range to contrast with linoleum floor covering **OR** Match linoleum floor covering, **as directed**.
4. Integral-Flash-Cove-Base Accessories:
   a. Cove Strip: 1-inch (25.4-mm) radius provided or approved by manufacturer.
   b. Cove-Base Cap Strip: Square metal, vinyl, or rubber cap provided or approved by manufacturer.
5. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

1.3 EXECUTION

A. Preparation
1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
2. Concrete Substrates: Prepare according to ASTM F 710.
   a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   b. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
4. Do not install floor coverings until they are same temperature as space where they are to be installed.
   a. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
5. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

B. Installation, General
1. Comply with manufacturer's written instructions for installing floor coverings.
2. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
3. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
4. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.
5. Install floor coverings on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of floor covering installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
6. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
7. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

C. Linoleum Floor Tile Installation
1. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   a. Lay floor tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in pattern indicated, **as directed**.
2. Match floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
   a. Lay floor tiles with grain running in one direction **OR** with grain direction alternating in adjacent floor tiles (basket-weave pattern) **OR** in pattern of colors and sizes indicated, **as directed**.

D. Linoleum Sheet Flooring Installation
1. Unroll sheet floorings and allow them to stabilize before cutting and fitting.
2. Lay out sheet floorings as follows:
   a. Maintain uniformity of floor covering direction.
   b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
   c. Match edges of floor coverings for color shading at seams.
   d. Avoid cross seams.
   e. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3. Integral-Flash-Cove Base: Cove linoleum floor covering 6 inches (152 mm) **OR** dimension indicated, **as directed**, up vertical surfaces. Support floor covering at horizontal and vertical junction with cove strip. Butt at top against cap strip.

E. Cleaning And Protection
1. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
2. Perform the following operations immediately after completing floor covering installation:
   a. Remove adhesive and other blemishes from exposed surfaces.
   b. Sweep and vacuum surfaces thoroughly.
   c. Damp-mop surfaces to remove marks and soil.
3. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor coverings before applying liquid floor polish.
   a. Apply two **OR** three, **as directed**, coat(s).
5. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover floor coverings until Final Completion.

END OF SECTION 09 65 13 33a

Task	Specification	Specification Description
09 65 13 33	01 22 16 00	No Specification Required
09 65 13 33	09 65 13 13	Cork Flooring
09 65 13 33	09 65 23 00	Resilient Sheet Flooring
09 65 13 33	09 65 13 13a	Resilient Wall Base And Accessories
09 65 13 36	09 65 13 13	Cork Flooring
09 65 13 36	09 65 13 13a	Resilient Wall Base And Accessories
09 65 16 23	09 65 13 13	Cork Flooring
09 65 16 23	09 65 23 00	Resilient Sheet Flooring
09 65 19 19	09 65 13 13	Cork Flooring
09 65 19 19	09 65 13 33	Resilient Floor Tile
09 65 19 23	09 65 13 13	Cork Flooring
09 65 19 23	09 65 13 33	Resilient Floor Tile
09 65 19 33	09 65 13 13	Cork Flooring
09 65 19 33	09 65 13 33	Resilient Floor Tile
09 65 19 43	09 65 13 13	Cork Flooring
09 65 19 43	09 65 13 33	Resilient Floor Tile

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SECTION 09 65 23 00 - RESILIENT SHEET FLOORING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for resilient sheet floor flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Vinyl sheet floor covering, with and without backing.
b. Rubber sheet floor covering, with and without backing.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit EQ 4.1: For adhesives and chemical-bonding compounds, including printed statement of VOC content.
3. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
a. Show details of special patterns.
4. Samples: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of floor covering required.
a. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.
5. Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
6. Maintenance data.

D. Quality Assurance
1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling
1. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

F. Project Conditions
1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive floor coverings during the following time periods:
a. 48 hours before installation.
b. During installation.
c. 48 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during floor covering installation.
4. Close spaces to traffic for 48 hours after floor covering installation.
5. Install floor coverings after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Vinyl Sheet Floor Covering
1. Unbacked Vinyl Sheet Floor Covering: ASTM F 1913, 0.080 inch (2.0 mm) thick.
2. Vinyl Sheet Floor Covering with Backing: ASTM F 1303.
   a. Type (Binder Content): Type I, minimum binder content of 90 percent **OR** Type II, minimum binder content of 34 percent, **as directed**.
   b. Wear-Layer Thickness: Grade 1.
   c. Overall Thickness: As standard with manufacturer.
   d. Interlayer Material: Foamed plastic **OR** None, **as directed**.
   e. Backing Class: Class A (fibrous) **OR** Class B (nonfoamed plastic) **OR** Class C (foamed plastic), **as directed**.
3. Wearing Surface: Smooth **OR** Embossed **OR** Smooth with embedded abrasives **OR** Embossed with embedded abrasives, **as directed**.
4. Sheet Width: As standard with manufacturer **OR** 4.9 feet (1.5 m) **OR** 6 feet (1.8 m) **OR** 6.5 feet (1.98 m) **OR** 6.6 feet (2.0 m) **OR** 9 feet (2.7 m) **OR** 12 feet (3.6 m), **as directed**.
5. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
6. Colors and Patterns: As selected from full range of industry colors.

B. Rubber Sheet Floor Covering
1. Unbacked Rubber Sheet Floor Covering: ASTM F 1859.
   a. Type: Type I (homogeneous rubber sheet) **OR** Type II (layered rubber sheet), **as directed**.
   b. Thickness: As standard with manufacturer.
2. Rubber Sheet Floor Covering with Backing: ASTM F 1860.
   a. Type: Type I, homogeneous rubber sheet with backing **OR** Type II, layered rubber sheet with backing, **as directed**.
   b. Wear-Layer Thickness: As standard with manufacturer.
   c. Overall Thickness: As standard with manufacturer.
   d. Interlayer Material: As standard with manufacturer **OR** None, **as directed**.
   e. Backing Type: Fibrous) **OR** Foamed rubber, **as directed**.
3. Hardness: Not less than required by ASTM F 1859 **OR** Not less than required by ASTM F 1860 **OR** Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240, **as directed**.
4. Wearing Surface: Smooth **OR** Textured **OR** Molded pattern, **as directed**.
   a. Molded-Pattern Figure: Raised discs **OR** Raised squares, **as directed**.
5. Sheet Width: As standard with manufacturer **OR** 4.9 feet (1.5 m) **OR** 6 feet (1.8 m) **OR** 6.5 feet (1.98 m) **OR** 6.6 feet (2.0 m) **OR** 9 feet (2.7 m) **OR** 12 feet (3.6 m), **as directed**.
6. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
7. Colors and Patterns: As selected from full range of industry colors.

C. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
   a. Use adhesives that have a VOC content of not more than 50 g/L **OR** 60 g/L, **as directed**, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Seamless-Installation Accessories:
   a. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
      1) Color: As selected from manufacturer's full range to contrast with floor covering **OR** Match floor covering, **as directed**.
   b. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

1) VOC Content: Not more than 510 g/L. when calculated according to 40 CFR 59, Subpart D (EPA method 24).

4. Integral-Flash-Cove-Base Accessories:
   a. Cove Strip: 1-inch (25-mm) radius provided or approved by manufacturer.
   b. Cap Strip: Square metal, vinyl, or rubber cap **OR** Tapered vinyl cap, **as directed**, provided or approved by manufacturer.
   c. Corners: Metal inside and outside corners and end stops provided or approved by manufacturer.
5. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

1.3 EXECUTION

A. Preparation
1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
2. Concrete Substrates: Prepare according to ASTM F 710.
   a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
4. Do not install floor coverings until they are same temperature as space where they are to be installed.
   a. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
5. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

B. Floor Covering Installation
1. Comply with manufacturer's written instructions for installing floor coverings.
2. Unroll floor coverings and allow them to stabilize before cutting and fitting.
3. Lay out floor coverings as follows:
   a. Maintain uniformity of floor covering direction.
   b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
   c. Match edges of floor coverings for color shading at seams.
   d. Avoid cross seams.
4. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
5. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
6. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

7. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
8. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
9. Seamless Installation:
    a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
    b. Chemically-Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly-fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.
10. Integral-Flash-Cove Base: Cove floor coverings 6 inches (152 mm) **OR** dimension indicated, **as directed**, up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.
    a. Install metal corners at inside and outside corners.

C. Cleaning And Protection
1. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
2. Perform the following operations immediately after completing floor covering installation:
    a. Remove adhesive and other blemishes from floor covering surfaces.
    b. Sweep and vacuum floor coverings thoroughly.
    c. Damp-mop floor coverings to remove marks and soil.
3. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor covering before applying liquid floor polish.
    a. Apply one **OR** two **OR** three, **as directed**, coat(s).
5. Cover floor coverings until Final Completion.

END OF SECTION 09 65 23 00

Task	Specification	Specification Description
09 65 23 00	09 65 13 13	Cork Flooring
09 65 43 00	09 65 13 13	Cork Flooring
09 65 43 00	09 65 23 00	Resilient Sheet Flooring

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SECTION 09 65 66 00 - FLUID-APPLIED ATHLETIC FLOORING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for fluid-applied sports flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes polyurethane flooring that is fluid applied directly on substrates or over base mats.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show installation details for flooring including layout, colors, widths, and dimensions of game lines and markers and locations of athletic equipment floor inserts.
3. Samples: For each color, gloss, and texture of flooring required, 12 inches (305 mm) square, applied to a rigid backing. Include sample sets showing the game-line paint and marker paint colors applied to the flooring.
4. Qualification Data: For Installer.
5. Maintenance Data: For fluid-applied sports flooring to include in maintenance manuals.

D. Quality Assurance
1. Installer Qualifications: An installer (applicator) who is approved, trained, or certified by fluid-applied sports flooring manufacturer.
2. Game Lines and Markers: Comply with requirements of National Collegiate Athletic Association (NCAA) **OR** National Federation of State High School Associations, **as directed,** for sports activities indicated.

E. Field Conditions
1. Environmental Limitations: Comply with flooring manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting flooring application.
   a. Do not apply flooring until spaces are enclosed and weatherproof; wet work in spaces is complete and dry; and overhead work, including installing mechanical systems, lighting, and athletic equipment, is complete.
2. Conditioning Period: Begins not less than seven days before flooring application, is continuous through application, and continues not less than three days after application.
   a. During conditioning period, maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and not more than 50 percent relative humidity in spaces to receive flooring.
   b. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

1.2 PRODUCTS

A. Direct-Applied Flooring:
1. Description: Fluid-applied athletic flooring system consisting of primer and polyurethane body and top coats applied directly to substrate.
2. Performance:
   a. Low-Emitting Materials: Provide products with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1) Primer: VOC content of not less than 250 g/L.
2) Body and Top Coats: VOC content of not more than 100 g/L.

b. Low-Emitting Materials: Provide adhesives, paints and coatings, and flooring systems that comply with the maximum allowable concentrations of VOC's when tested according to California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. Materials:
   a. Primer: Manufacturer's primer recommended for substrate indicated.
   b. Body Coat(s): Two-component, self-leveling, pigmented, polyurethane containing no rubber fillers and no mercury.
   c. Topcoat (Finish Coat): Manufacturer's standard pigmented polyurethane.
   d. Finishes:
      1) Color: As selected from manufacturer's full range.
      2) Surface Texture: Manufacturer's standard.

B. Flooring Applied over Base Mats:
1. Description: Fluid-applied athletic flooring system consisting of resilient base mat adhered to substrate, base mat sealer, and fluid-applied polyurethane body and top coats.
2. Performance:
   a. Low-Emitting Materials: Provide products with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      1) Base Mat Adhesive: VOC content of not more than 60 g/L.
      2) Base Mat Sealer: VOC content of not more than 200 g/L.
      3) Body and Topcoats: VOC content of not more than 100 g/L.
   b. Low-Emitting Materials: Provide adhesives, paints and coatings, and flooring systems that comply with the maximum allowable concentrations of VOC's when tested according to California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Materials:
   a. Base Mat: Manufacturer's standard base mats of granulated recycled rubber in polyurethane binder.
      1) Thickness: **5/32 inch (4 mm) OR 1/4 inch (6 mm) OR 9/32 inch (7 mm) OR 11/32 inch (9 mm) OR 15/32 inch (12 mm).**
   b. Base-Mat Adhesive: Manufacturer's standard two-component polyurethane.
   c. Base-Mat Sealer: Manufacturer's standard two-component polyurethane compound formulated for sealing base mat.
   d. Body Coat(s): Two-component, self-leveling, pigmented, polyurethane containing no rubber fillers and no mercury.
   e. Topcoat (Finish Coat): Manufacturer's standard pigmented polyurethane.
4. Finishes:
   a. Color: As selected by Architect from manufacturer's full range.
   b. Surface Texture: Manufacturer's standard.

C. Accessories
1. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
2. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.
   a. VOC content: Provide products with VOC content of not more than 150 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Colors: As selected **OR** As required to comply with game-line and marker requirements of sports association indicated, **as directed**.

1.3 EXECUTION

A. Examination
1. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
a. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
b. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Concrete Substrates: Prepare and clean substrates according to manufacturer's written instructions.
a. Remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair flooring bond. Remove contaminants using mechanical means.
b. Treat nonmoving substrate cracks and control joints to prevent cracks from telegraphing (reflecting) through flooring according to manufacturer's written recommendations.
c. Protect substrate voids and joints to prevent flooring resins from flowing into or leaking through them.
2. Protect walls, floor openings, athletic equipment inserts, electrical openings, door frames, and other obstructions during installation. Cover floor and wall areas at mixing stations.

C. Flooring Installation, General
1. General: Mix and apply flooring components according to manufacturer's written instructions.
a. At substrate expansion, isolation, and other moving joints, install continuous joint of same width through flooring.

D. Installation of Direct-Applied Flooring:
1. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
2. Apply body coat(s) and topcoat to produce a uniform, level surface and finish.

E. Installation of Flooring Applied over Base Mats:
a. Adhesively apply resilient base mats to substrate according to manufacturer's written instructions.
1) Base mats must not be in compression. Leave gap of width recommended in writing by manufacturer at butted base-mat sheets, walls, floor openings, athletic equipment inserts, electrical openings, door frames, and other obstructions.
2) Roll base mats to set them into adhesive and eliminate air pockets.
3) Repair ridges at seams, loose areas, and air pockets according to manufacturer's written instructions.
b. Apply seal coat to base mats before applying body coat(s).
c. Smooth ridges and high spots in seal coat before applying elastomeric resin.
d. Apply elastomeric resin and topcoat to produce a uniform surface and finish.

F. Game Lines And Markers
1. Mask flooring surfaces at game lines and markers, and apply paint to produce sharp edges.
a. Where game lines cross, break minor game line at intersection; do not overlap lines.
b. Apply game lines and markers in widths and colors according to requirements indicated on Drawings **OR** sports association indicated, **as directed**.

G. Protection
1. Protect fluid-applied sports flooring during remainder of construction period to allow it to cure and to ensure that flooring and finish are without damage or deterioration at the time of Final Completion.

END OF SECTION 09 65 66 00

SECTION 09 65 66 00a - RESILIENT SPORTS-FLOOR COVERINGS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for resilient sports-floor coverings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Interlocking, rubber floor tile.
b. Interlocking, suspended, polymer floor tile.
c. Interlocking, open-grid, vinyl floor tile.
d. Rubber mats.
e. Rubber floor tile.
f. Rubber-strip floor tile.
g. Rubber sheet floor covering.
h. Sheet vinyl floor covering.

C. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Show installation details and locations of the following:
a. Border tiles.
b. Floor patterns.
c. Layout, colors, widths, and dimensions of game lines.
d. Locations of floor inserts for athletic equipment.
e. Seam locations.
3. Samples: For each exposed finish.
4. LEED Submittals:
a. Credit EQ 4.1: Manufacturers' product data for adhesives, including printed statement of VOC content.
b. Credit EQ 4.2: Manufacturers' product data for game-line and marker paints, including printed statement of VOC content.
c. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement that indicates costs for each product having recycled content.
5. Maintenance data.

D. Delivery, Storage, And Handling
1. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
2. Store materials to prevent deterioration. Store tiles on flat surfaces and rolls upright.

E. Field Conditions
1. Adhesively Applied Products:
a. Maintain temperatures within range recommended in writing by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor coverings during the following time periods:
1) 48 hours before installation, unless longer period is recommended in writing by manufacturer.
2) During installation.

3) 48 hours after installation, unless longer period is recommended in writing by manufacturer.

b. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

c. Close spaces to traffic during floor covering installation.

d. Close spaces to traffic for 48 hours after floor covering installation, unless manufacturer recommends longer period in writing.

2. Install floor coverings after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Interlocking, Rubber Floor Tile

1. Material: Rubber **OR** Recycled-rubber compound, **as directed**.
2. Installation Method: Free lay.
3. Tile Interlock: Visible **OR** Hidden, **as directed**.
4. Traffic-Surface Texture: Smooth **OR** Nondirectional, stipple texture **OR** Textured, **as directed**.
   a. Provide reversible tiles (with traffic-surface texture on both sides).
5. Size: Manufacturer's standard-size square tile, not less than 24 inches (610 mm) square.
6. Thickness: 3/8 inch (9.5 mm) **OR** 7/16 inch (11.1 mm) **OR** 1/2 inch (13 mm) **OR** 9/16 inch (14.3 mm) **OR** 3/4 inch (19 mm), **as directed**.
7. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.
8. Accessories:
   a. Border Tiles: Interlocking, beveled-edge tiles, of same material as floor tile, with bevels that transition from thickness of floor tile to surface below it, with straight outside edges, and for use where floor covering corners and edges do not abut vertical surfaces.
      1) Color and Pattern: Matching floor tile **OR** As selected from manufacturer's full range to contrast with floor tile **OR** As indicated by manufacturer's designations, **as directed**.

B. Interlocking, Suspended, Polymer Floor Tile

1. Material and Construction: High-impact-polymer modular floor tile with top suspended over supporting backing that intermittently contacts the substrate.
   a. Traffic Surface: Solid.
2. Installation Method: Free lay.
3. Tile Interlock: Manufacturer's standard.
4. Size: Manufacturer's standard-size square tile **OR** 12 inches (305 mm) square **OR** 9.8 inches (250 mm) square, **as directed**.
5. Thickness: 1/2 inch (13 mm).
6. Color: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.
7. Accessories:
   a. Border Tiles: Interlocking, beveled-edge tiles, of same material as floor tile, with bevels that transition from thickness of floor tile to surface below it, with straight outside edges, and for use where floor covering corners and edges do not abut vertical surfaces.
      1) Color: Matching floor tile **OR** As selected from manufacturer's full range to contrast with floor tile **OR** As indicated by manufacturer's designations, **as directed**.
   b. Game-Line and Marker Paint: Complete system including primer, if any, compatible with floor covering and recommended in writing by floor covering and paint manufacturers for use indicated.
   c. Underlayment:
      1) Material: Manufacturer's standard rubber compound **OR** Recycled-rubber compound, **as directed**.
      2) Thickness: 0.08 inch (2 mm) **OR** 0.12 inch (3 mm), **as directed**.

C. Interlocking, Open-Grid, Vinyl Floor Tile
1. Material: Vinyl **OR** Recycled-plastic compound, **as directed**.
2. Installation Method: Free lay.
3. Tile Interlock: Manufacturer's standard.
4. Size: 12 inches (305 mm) square.
5. Thickness: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 7/16 inch (11.1 mm) **OR** 3/4 inch (19 mm), **as directed**.
6. Color: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.
7. Accessories:
   a. Border Tiles: Interlocking, beveled-edge tiles, of same material as floor tile, with bevels that transition from thickness of floor tile to surface below it, with straight outside edges, and for use where floor covering corners and edges do not abut vertical surfaces.
      1) Color: Matching floor tile **OR** As selected from manufacturer's full range to contrast with floor tile **OR** As indicated by manufacturer's designations, **as directed**.

D. Rubber Mats
1. Material: Recycled-rubber compound.
2. Installation Method: Free lay.
3. Traffic-Surface Texture: Smooth.
4. Size: 48 by 72 inches (1219 by 1829 mm).
5. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**.
6. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.

E. Rubber Floor Tile
1. Material: Rubber **OR** Recycled-rubber compound **OR** Rubber wear layer and rubber shock-absorbent layer, vulcanized together, **as directed**.
2. Installation Method: Adhered.
3. Traffic-Surface Texture: Smooth **OR** Nondirectional, stipple texture **OR** Textured, **as directed**.
4. Size: Manufacturer's standard-size square tile **OR** 18 inches (457 mm) square **OR** 24 inches (610 mm) square **OR** 36 inches (914 mm) square, **as directed**.
5. Thickness: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
6. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.
7. Accessories:
   a. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by floor covering manufacturer.
   b. Installation Adhesive: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
      1) Use adhesive that has a VOC content of 60 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Rubber-Strip Floor Tile
1. Materials and Construction: Close-nap, carpetlike tiles of rubber-fabric strips, made from recycled tires, bonded to a dry-adhesive backing that acts as a catalyst with installation adhesive to form tile-to-substrate bond.
2. Fire-Test-Response Characteristics: Passing 16 CFR 1630 (DOC FF-1-70).
3. Installation Method: Adhered.
4. Size: 12 inches (305 mm) square.
5. Thickness: 3/8 inch (9.5 mm).
6. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.
7. Accessories:
   a. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by floor covering manufacturer.

b. Installation Adhesive: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
   1) Use adhesive that has a VOC content of 60 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Rubber Sheet Flooring
1. Description: Rubber athletic flooring provided as rolled goods for adhered installation.
2. Material: Recycled-rubber compound **OR** Rubber wear layer and rubber shock-absorbent layer, vulcanized together, **as directed**.
3. Traffic-Surface Texture: Smooth.
4. Roll Size: Not less than 48 inches (1219 mm) wide by longest length that is practical to minimize splicing during installation.
5. Thickness: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
6. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.
7. Border: Interlocking, beveled-edge tiles, of same material as floor tile; with bevels that transition from thickness of floor tile to surface below it; with straight outside edges; and for use where flooring corners and edges do not abut vertical surfaces.
   a. Border Color and Pattern: Matching floor tile **OR** As selected from manufacturer's full range to contrast with floor tile, **as directed**.

H. Sheet Vinyl Flooring
1. Description: Sheet vinyl flooring specifically designed for adhered athletic flooring applications.
2. Unbacked Sheet Vinyl Flooring: ASTM F 1913, 0.080 inch (2.0 mm) thick.
   a. Separate underlayment pad of bonded recycled rubber and polyurethane particles.
3. Sheet Vinyl Flooring with Backing: ASTM F 1303.
   a. Type (Binder Content): I, minimum binder content of 90 percent **OR** II, minimum binder content of 34 percent, **as directed**.
   b. Wear-Layer Thickness: Grade 1.
   c. Interlayer Material: Foamed plastic **OR** None, **as directed**.
   d. Backing Class: Class B (nonfoamed plastic) **OR** C (foamed plastic), **as directed**.
4. Seaming Method: Heat welded **OR** Chemically bonded, **as directed**.
5. Traffic-Surface Texture: Smooth **OR** Embossed, **as directed**.
6. Applied Finish: Factory-applied UV urethane **OR** Field-applied polyurethane, **as directed**.
7. Roll Size: Not less than 48 inches (1219 mm) wide by longest length that is practical to minimize splicing during installation.
8. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by manufacturer's designations, **as directed**.

I. Accessories:
1. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by floor covering manufacturer.
2. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
   a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Game-Line and Marker Paint: Complete system including primer, if any, compatible with floor covering and recommended in writing by floor covering and paint manufacturers for use indicated.
   a. VOC content: Provide products with VOC content not more than 150 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Preparation

1. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.
2. Concrete Substrates: Prepare according to ASTM F 710.
   a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   b. Alkalinity and Adhesion Testing: Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.
   c. Moisture Testing:
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
         a) Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.
      2) Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.
3. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
4. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
5. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless manufacturer recommends a longer period in writing.
   a. Do not install floor coverings until they are same temperature as space where they are to be installed.
6. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Flooring Installation, General
1. Comply with manufacturer's written installation instructions.
2. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
3. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.
4. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on floor coverings. Use nonpermanent, nonstaining marking device.

C. Floor Tile Installation
1. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   a. Lay tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in pattern indicated, **as directed**.
2. Discard broken, cracked, chipped, or deformed tiles.
3. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered.
   a. Lay tiles with grain running in one direction **OR** with grain direction alternating in adjacent tiles (basket-weave pattern) **OR** in pattern of colors and sizes indicated, **as directed**.

D. Sheet Flooring Installation
1. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.
2. Lay out sheet floor coverings as follows:
   a. Maintain uniformity of floor covering direction.
   b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
   c. Match edges of floor coverings for color shading at seams.

d. Locate seams per approved Shop Drawings.

3. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   a. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
4. Vinyl Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.
   a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.
   b. Chemically Bonded Seams: Comply with ASTM F 693. Seal seams to prevent openings from forming between cut edges and to prevent penetration of dirt, liquids, and other substances into seams.

E. Game Lines And Markers
1. Mask floor coverings at game lines and markers, and apply paint to produce sharp edges.Where cross, break minor game line at intersection; do not overlap lines.
2. Lay out game lines and markers to comply with rules and diagrams published by National Collegiate Athletic Association (NCAA) **OR** National Federation of State High School Associations for athletic activities indicated.

F. Field-Applied Finishes
1. Apply finish after game-line and marker paint is fully cured.
2. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.
3. Do not cover floor coverings after finishing until finish reaches full cure.

G. Cleaning And Protecting
1. Perform the following operations immediately after completing floor covering installation:
   a. Remove adhesive and other blemishes from floor covering surfaces.
   b. Sweep and vacuum floor coverings thoroughly.
   c. Damp-mop floor coverings to remove marks and soil.
      1) Do not wash floor coverings until after time period recommended in writing by manufacturer.
2. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   a. Do not move heavy and sharp objects directly over floor coverings. Protect floor coverings with plywood or hardboard panels to prevent damage from storing or moving objects over floor coverings.

END OF SECTION 09 65 66 00a

Task	Specification	Specification Description
09 65 66 00	09 65 13 33	Resilient Floor Tile
09 66 13 00	09 01 60 91	Portland Cement Terrazzo Flooring
09 66 13 13	09 01 60 91	Portland Cement Terrazzo Flooring
09 66 13 16	09 01 60 91	Portland Cement Terrazzo Flooring
09 66 13 19	09 01 60 91	Portland Cement Terrazzo Flooring
09 66 16 13	09 01 60 91	Portland Cement Terrazzo Flooring

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SECTION 09 66 23 00 - RESINOUS MATRIX TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for resinous matrix terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Thin-set epoxy-resin terrazzo flooring and base.
b. Precast terrazzo units.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
1) Include statement that indicates cost for each product having recycled content.
b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected.
5. Installer certificates.
6. Qualification data.
7. Material certificates.
8. Maintenance data.

D. Quality Assurance
1. Installer Qualifications: A qualified installer who is acceptable to terrazzo manufacturer to install manufacturer's products.
a. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
b. Engage an installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions
1. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

2. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
3. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
4. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
5. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
   a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Epoxy-Resin Terrazzo
   1. Materials:
      a. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate crack preparation and reflective crack reduction.
         1) Reinforcement: Fiberglass scrim.
      b. Primer: Manufacturer's product recommended for substrate and use indicated.
      c. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
         1) Physical Properties without Marble Chips **OR** Aggregates, **as directed**:
            a) Hardness: 60 to 85 per ASTM D 2240, Shore D.
            b) Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D 638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D 412.
            c) Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D 695, Specimen B cylinder.
            d) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
               i. Distilled water.
               ii. Mineral water.
               iii. Isopropanol.
               iv. Ethanol.
               v. 0.025 percent detergent solution.
               vi. 1.0 percent soap solution.
               vii. 10 percent sodium hydroxide.
               viii. 10 percent hydrochloric acid.
               ix. 30 percent sulfuric acid.
               x. 5 percent acetic acid.
         2) Physical Properties with Marble Chips **OR** Aggregates, **as directed**: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide," comply with the following:
            a) Flammability: Self-extinguishing, maximum extent of burning 0.25 inch (6.35 mm) per ASTM D 635.
            b) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) for temperature range of minus 12 to plus 140 deg F (minus 24 to plus 60 deg C) per ASTM D 696.
      d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
         1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
         2) 24-Hour Absorption Rate: Less than 0.75 percent.
         3) Dust Content: Less than 1.0 percent by weight.
      e. Finishing Grout: Resin based.

2. Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip proportions and mixing.
   a. Formulated Mix Color and Pattern: As selected by the Owner from manufacturer's full range **OR** As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA thin-set terrazzo plates, **as directed**.
3. Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
   a. Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.

B. Strip Materials
1. Thin-Set Divider Strips: L-type angle or T-type, 1/4 inch (6.4 mm) deep.
   a. Material: White-zinc alloy **OR** Brass **OR** Aluminum **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
   b. Top Width: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
2. Heavy-Top Divider Strips: L-type angle in depth required for topping thickness indicated.
   a. Bottom-Section Material: Galvanized steel **OR** Matching top-section material, **as directed**.
   b. Top-Section Material: White-zinc alloy **OR** Brass **OR** Aluminum **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
   c. Top-Section Width: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
3. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.
4. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
   a. Base-bead strips for exposed top edge of terrazzo base.
   b. Edge-bead strips for exposed edges of terrazzo.
   c. Nosings for terrazzo stair treads and landings.
5. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
   a. Width: 1/2 inch (12.7 mm).
   b. Depth: As required by terrazzo thickness.
   c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
   d. Color: As selected from manufacturer's full range.

C. Miscellaneous Accessories
1. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
   a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Anchoring Devices:
   a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
   b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
3. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
4. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
5. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
6. Sealer: Slip- and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by

sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated **OR** Acrylic **OR** Urethane **OR** Chemical-resistant epoxy, **as directed**.

D. Precast Terrazzo
1. Precast Terrazzo Units: Precast epoxy-resin terrazzo base**,** stair tread, threshold, bench, and planter units.
2. Precast Terrazzo Base Units: 1/4 inch (6.4 mm) thick; cast in maximum lengths possible, but not less than 36 inches (900 mm); with rounded, finished top edge.
   a. Type: Coved with minimum 3/4-inch (19-mm) radius **OR** Straight **OR** Splayed **OR** As indicated, **as directed**.
   b. Height: 6 inches (152 mm) **OR** 4 inches (101 mm) **OR** As indicated, **as directed**.
   c. Outside Corner Units: With finished returned edges at outside corner.
   d. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
3. Precast Terrazzo Stair Treads: 1/2 inch (12.7 mm) thick with rounded nosing edge.
   a. Abrasive Strips: Three-line **OR** Two-line **OR** One-line **OR** Abrasive nosing strip and two-line, **as directed**, abrasive inserts at nosings.
   b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
4. Precast Terrazzo Finishing (for custom precast terrazzo components):
   a. Finish exposed-to-view edges or reveals to match face finish.
   b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation
1. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
2. Concrete Slabs:
   a. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
      1) Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      2) Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
      3) Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
   b. Verify that concrete substrates are visibly dry and free of moisture.
   c. Moisture Testing:
      1) Test for moisture by anhydrous calcium chloride method according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Test for moisture by relative humidity probe and digital meter method according to ASTM F 2170. Proceed with installation only after substrates have a maximum relative-humidity-measurement reading of 70 to 75 percent in 24 hours.
      3) Test for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.
3. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
   a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

4. Installation of terrazzo indicates acceptance of surfaces and conditions.

B. Epoxy-Resin Terrazzo Installation
1. General:
   a. Comply with NTMA's written recommendations for terrazzo and accessory installation.
   b. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
   c. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
   d. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
   e. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
2. Thickness: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As indicated, **as directed**, nominal.
3. Flexible Reinforcing Membrane:
   a. Prepare and prefill substrate cracks with membrane material.
   b. Install membrane to produce full substrate coverage in areas to receive terrazzo.
   c. Reinforce membrane with fiberglass scrim.
   d. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
4. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
5. Strip Materials:
   a. Divider and Control-Joint Strips:
      1) Locate divider strips in locations indicated.
      2) Install control-joint strips back to back directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
      3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
      4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
   b. Accessory Strips: Install accessory strips as required to provide a complete installation **OR** in locations indicated, **as directed**.
   c. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.
6. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
7. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.

C. Precast Terrazzo Installation
1. Install precast terrazzo units using method recommended NTMA and manufacturer unless otherwise indicated.
2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8-inch (3.2-mm) maximum in length, height, or width; noncumulative.
3. Do not install units that are chipped, cracked, discolored, or not properly finished.
4. Seal joints between units with joint compound matching precast terrazzo matrix **OR** joint sealant, **as directed**.

D. Cleaning And Protection
1. Cleaning:
   a. Remove grinding dust from installation and adjacent areas.

b. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.

2. Sealing:
   a. Seal surfaces according to NTMA's written recommendations.
   b. Apply sealer according to sealer manufacturer's written instructions.
3. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.

END OF SECTION 09 66 23 00

Task	Specification	Specification Description
09 66 23 16	09 66 23 00	Resinous Matrix Terrazzo Flooring
09 66 33 13	09 66 23 00	Resinous Matrix Terrazzo Flooring
09 66 33 16	09 66 23 00	Resinous Matrix Terrazzo Flooring
09 66 33 19	09 66 23 00	Resinous Matrix Terrazzo Flooring

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SECTION 09 67 16 00 - RESINOUS FLOORING

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Decorative resinous flooring systems.
b. Industrial resinous flooring systems.
c. High-performance resinous flooring systems.

C. Submittals
1. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
2. LEED Submittal:
a. Product Data for Credit EQ 4.2: For resinous flooring systems, documentation including printed statement of VOC content and chemical components.
3. Samples: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.
4. Product Schedule: For resinous flooring. Use same designations indicated on Drawings.
5. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
6. Material Certificates: For each resinous flooring component, from manufacturer.
7. Material Test Reports: For each resinous flooring system.
8. Maintenance Data: For resinous flooring to include in maintenance manuals.

D. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
a. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
2. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

F. Project Conditions
1. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
2. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

3. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.2 PRODUCTS

A. Materials
1. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Resinous Flooring: 100 g/L.

B. Decorative Resinous Flooring
1. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base, **as directed**.
2. System Characteristics:
   a. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by product designation, **as directed**.
   b. Wearing Surface: Textured for slip resistance **OR** Orange-peel texture **OR** Smooth **OR** Manufacturer's standard wearing surface, **as directed**.
   c. Overall System Thickness: 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
   d. Federal Agency Approvals: USDA **OR** FDA, **as directed**, approved for food-processing environments.
3. Body Coats:
   a. Resin: Epoxy.
   b. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
   c. Application Method: Self-leveling slurry with broadcast aggregates **OR** Self-leveling slurry **OR** Troweled or screeded, **as directed**.
      1) Thickness of Coats: 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
      2) Number of Coats: One **OR** Two, **as directed**.
   d. Aggregates: Manufacturer's standard **OR** Colored quartz (ceramic-coated silica) **OR** Vinyl flakes **OR** Granite **OR** Natural silica, **as directed**.
4. Topcoat: Sealing or finish coats.
   a. Resin: Epoxy **OR** Urethane **OR** Vinyl ester, **as directed**.
   b. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
   c. Type: Clear **OR** Pigmented, **as directed**.
   d. Finish: Matte **OR** Gloss, **as directed**.
   e. Number of Coats: One **OR** Two, **as directed**.
5. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   a. Compressive Strength: per ASTM C 579.
   b. Tensile Strength: per ASTM C 307.
   c. Flexural Modulus of Elasticity: per ASTM C 580.
   d. Water Absorption: per ASTM C 413.
   e. Coefficient of Thermal Expansion: per ASTM C 531.
   f. Indentation: per MIL-D-3134.
   g. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
   h. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
   i. Abrasion Resistance: maximum weight loss per ASTM D 4060.
   j. Flammability: Self-extinguishing per ASTM D 635.

k. Critical Radiant Flux: 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**, or greater per NFPA 253.
l. Hardness: Shore D per ASTM D 2240.
m. Bond Strength: 100 percent concrete failure per ACI 503R.

6. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion **OR** ASTM D 543, Procedure A, for immersion **OR** ASTM C 267 for immersion, **as directed**, in reagents **as directed** for no fewer than seven days.

C. Industrial Resinous Flooring
1. Resinous Flooring: Abrasion-, impact- and chemical-resistant, industrial-aggregate-filled, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base, **as directed**.
2. System Characteristics:
a. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by product designation, **as directed**.
b. Wearing Surface: Textured for slip resistance **OR** Orange-peel texture **OR** Smooth **OR** Manufacturer's standard wearing surface, **as directed**.
c. Overall System Thickness: 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
d. Federal Agency Approvals: USDA **OR** FDA, **as directed**, approved for food-processing environments.
3. Body Coats:
a. Resin: Epoxy **OR** Urethane **OR** Vinyl ester, **as directed**.
b. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
c. Application Method: Self-leveling slurry with broadcast aggregates **OR** Self-leveling slurry **OR** Troweled or screeded, **as directed**.
1) Thickness of Coats: 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
2) Number of Coats: One **OR** Two, **as directed**.
d. Aggregates: Manufacturer's standard **OR** Colored quartz (ceramic-coated silica) **OR** Vinyl flakes **OR** Granite **OR** Natural silica, **as directed**.
4. Topcoat: Sealing or finish coats.
a. Resin: Epoxy **OR** Urethane **OR** Vinyl ester, **as directed**.
b. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
c. Type: Clear **OR** Pigmented, **as directed**.
d. Finish: Matte **OR** Gloss, **as directed**.
e. Number of Coats: One **OR** Two, **as directed**.
5. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
a. Compressive Strength: per ASTM C 579.
b. Tensile Strength: per ASTM C 307.
c. Flexural Modulus of Elasticity: per ASTM C 580.
d. Water Absorption: per ASTM C 413.
e. Coefficient of Thermal Expansion: per ASTM C 531.
f. Indentation: percent maximum per MIL-D-3134.
g. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
h. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
i. Abrasion Resistance: maximum weight loss per ASTM D 4060.
j. Flammability: Self-extinguishing per ASTM D 635.
k. Critical Radiant Flux: 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**, or greater per NFPA 253.
l. Hardness: Shore D per ASTM D 2240.
m. Bond Strength: 100 percent concrete failure per ACI 503R.

6. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion **OR** ASTM D 543, Procedure A, for immersion **OR** ASTM C 267 for immersion, **as directed**, in reagents **as directed** for no fewer than seven days.

D. High-Performance Resinous Flooring
1. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance-aggregate-filled, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base, **as directed**.
2. System Characteristics:
   a. Color and Pattern: As selected from manufacturer's full range **OR** As indicated by product designation, **as directed**.
   b. Wearing Surface: Textured for slip resistance **OR** Orange-peel texture **OR** Smooth **OR** Manufacturer's standard wearing surface, **as directed**.
   c. Overall System Thickness: 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
   d. Federal Agency Approvals: USDA **OR** FDA, **as directed**, approved for food-processing environments.
3. Body Coats:
   a. Resin: Epoxy **OR** Epoxy novolac **OR** Urethane **OR** Vinyl ester **OR** Methyl methacrylate, **as directed**.
   b. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
   c. Application Method: Self-leveling slurry with broadcast aggregates **OR** Self-leveling slurry **OR** Troweled or screeded, **as directed**.
      1) Thickness of Coats: 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
      2) Number of Coats: One **OR** Two, **as directed**.
   d. Aggregates: Manufacturer's standard **OR** Colored quartz (ceramic-coated silica) **OR** Vinyl flakes **OR** Granite **OR** Natural silica, **as directed**.
4. Topcoat: Sealing or finish coats.
   a. Resin: Epoxy **OR** Epoxy novolac **OR** Urethane **OR** Vinyl ester **OR** Methyl methacrylate, **as directed**.
   b. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
   c. Type: Clear **OR** Pigmented, **as directed**.
   d. Finish: Matte **OR** Gloss, **as directed**.
   e. Number of Coats: One **OR** Two, **as directed**.
5. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   a. Compressive Strength: per ASTM C 579.
   b. Tensile Strength: per ASTM C 307.
   c. Flexural Modulus of Elasticity: per ASTM C 580.
   d. Water Absorption: per ASTM C 413.
   e. Coefficient of Thermal Expansion: per ASTM C 531.
   f. Indentation: percent maximum per MIL-D-3134.
   g. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
   h. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
   i. Abrasion Resistancemaximum weight loss per ASTM D 4060.
   j. Flammability: Self-extinguishing per ASTM D 635.
   k. Critical Radiant Flux: 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**, or greater per NFPA 253.
   l. Hardness: Shore D per ASTM D 2240.
   m. Bond Strength: 100 percent concrete failure per ACI 503R.

6. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion **OR** ASTM D 543, Procedure A, for immersion **OR** ASTM C 267 for immersion, **as directed**, in reagents **as directed** for no fewer than seven days.

E. Accessories
1. Primer: Type recommended by manufacturer for substrate and body coats indicated.
   a. Formulation Description: 100 percent solids **OR** High solids **OR** Water based, **as directed**.
2. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated.
   a. Formulation Description: 100 percent solids **OR** High solids, **as directed**.
3. Reinforcing Membrane: Flexible resin formulation that is recommended by manufacturer for substrate and primer and body coats indicated and that prevents substrate cracks from reflecting through resinous flooring.
   a. Formulation Description: 100 percent solids **OR** High solids, **as directed**.
      1) Provide fiberglass scrim embedded in reinforcing membrane.
4. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

1.3 EXECUTION

A. Preparation
1. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
2. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   a. Roughen concrete substrates as follows:
      1) Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      OR
      Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
   b. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
   c. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab area in 24 hours.
      2) Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
      3) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   d. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
3. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
4. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
5. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

B. Application
1. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   a. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   b. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   c. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
2. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
3. Apply waterproofing membrane, where indicated, in manufacturer's recommended thickness.
   a. Apply waterproofing membrane to integral cove base substrates.
4. Apply reinforcing membrane to substrate cracks **OR** entire substrate surface, **as directed**.
5. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
   a. Integral Cove Base: 4 inches (100 mm) high.
6. Apply self-leveling slurry body coats in thickness indicated for flooring system.
   a. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
7. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.
8. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.
9. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

C. Field Quality Control
1. Core Sampling: At the direction of the Owner and at locations designated by the Owner, take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies.
2. Material Sampling: the Owner may at any time and any number of times during resinous flooring application require material samples for testing for compliance with requirements.
   a. Contractor will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   c. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

D. Protection
1. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 16 00

Task	Specification	Specification Description
09 67 23 00	09 67 16 00	Resinous Flooring

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SECTION 09 68 13 00 - CARPET TILE

1.1 GENERAL

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

B. Summary
1. This Section includes modular, fusion-bonded **OR** tufted, **as directed**, carpet tile.

C. Submittals
1. Product Data: For each product indicated.
2. Shop Drawings: Show the following:
   a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   b. Existing flooring materials to be removed.
   c. Existing flooring materials to remain.
   d. Carpet tile type, color, and dye lot.
   e. Type of subfloor.
   f. Type of installation.
   g. Pattern of installation.
   h. Pattern type, location, and direction.
   i. Pile direction.
   j. Type, color, and location of insets and borders.
   k. Type, color, and location of edge, transition, and other accessory strips.
   l. Transition details to other flooring materials.
3. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   a. Carpet Tile: Full-size Sample.
   b. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
4. LEED Submittal:
   a. Product Data for Credit EQ 4.3:
      1) For carpet tile, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
      2) For installation adhesive, including printed statement of VOC content.
5. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
6. Maintenance data.

D. Quality Assurance
1. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
2. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling
1. Comply with CRI 104, Section 5, "Storage and Handling."

F. Project Conditions
1. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
2. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
3. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
4. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

G. Warranty
1. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   a. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
   c. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

A. Carpet Tile
1. Fiber Content: 100 percent nylon 6, 6 **OR** 100 percent nylon 6 **OR** 100 percent polypropylene **OR** 100 percent wool **OR** 80 percent wool; 20 percent nylon 6, 6 **OR** 80 percent wool; 20 percent nylon 6, **as directed**.
2. Fiber Type: **<Insert proprietary fiber type**.>
3. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop, **as directed**, pile.
4. Yarn Twist: **<Insert twist in TPI (TPCM)**.>
5. Yarn Count: **<Insert yarn count**.>
6. Density: **<Insert oz./cu. yd. (g/cu. cm)**.>
7. Pile Thickness: **<Insert inches (mm)**> for finished carpet tile per ASTM D 6859.
8. Stitches: **<Insert stitches per inch (mm)**.>
9. Gage: **<Insert gage in ends per inch (mm)**.>
10. Surface Pile Weight: **<Insert oz./sq. yd. (g/sq. m)**.>
11. Total Weight: **<Insert oz./sq. yd. (g/sq. m)**> for finished carpet tile.
12. Primary Backing/Backcoating: Manufacturer's standard composite materials **OR** PVC **OR** Fiberglass-reinforced PVC **OR** Fiberglass-reinforced amorphous resin **OR** Reinforced polyurethane composite cushion **OR** Reinforced polyurethane composite **OR** Reinforced thermoplastic copolymer, **as directed**.
13. Secondary Backing: Manufacturer's standard material.
14. Backing System: **<Insert proprietary name**.>
15. Size: 18 by 18 inches (457 by 457 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 18 by 36 inches (457 by 914 mm) **OR** 36 by 36 inches (914 by 914 mm), **as directed**.
16. Applied Soil-Resistance Treatment: Manufacturer's standard material.
17. Antimicrobial Treatment: Manufacturer's standard material.
18. Performance Characteristics: As follows:
    a. Critical Radiant Flux Classification: Not less than0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
    b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
    c. Tuft Bind: Not less than 3 lbf (13 N) **OR** 5 lbf (22 N) **OR** 6.2 lbf (28 N) **OR** 8 lbf (36 N) **OR** 10 lbf (45 N), **as directed**, per ASTM D 1335.

d. Delamination: Not less than 3.5 lbf/in. (15 N/mm) **OR** 4 lbf/in. (18 N/mm), **as directed**, per ASTM D 3936.
e. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
f. Dimensional Stability: 0.2 percent or less per ISO 2551 (Aachen Test).
g. Resistance to Insects: Comply with AATCC 24.
h. Noise Reduction Coefficient (NRC): <**Insert NRC**> per ASTM C 423.
i. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
j. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
k. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
l. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
m. Environmental Requirements: Provide carpet tile that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

B. Installation Accessories
1. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
2. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
a. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.3 EXECUTION

A. Preparation
1. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
3. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
4. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
5. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

B. Installation
1. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
2. Installation Method: As recommended in writing by carpet tile manufacturer **OR** Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive **OR** Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive **OR** Free lay; install carpet tiles without adhesive, **as directed**.
3. Maintain dye lot integrity. Do not mix dye lots in same area.
4. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

5. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
7. Install pattern parallel to walls and borders.
8. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

C. Cleaning And Protection
1. Perform the following operations immediately after installing carpet tile:
   a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   b. Remove yarns that protrude from carpet tile surface.
   c. Vacuum carpet tile using commercial machine with face-beater element.
2. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
3. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13 00

Task	Specification	Specification Description
09 68 16 00	09 01 60 91a	Carpet
09 68 16 00	09 68 13 00	Carpet Tile

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SECTION 09 69 13 00 - ACCESS FLOORING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for access flooring. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Access flooring panels and understructure.
b. Floor panel coverings.

C. Definition
1. ESD: Electrostatic discharge. The transfer of electric charge between bodies at different potentials.

D. System Description
1. Access Flooring System: Assemblies composed of modular floor panels on pedestals with or without stringers.

E. Performance Requirements
1. Structural Performance: Provide access flooring systems capable of withstanding the following loads and stresses within limits and under conditions indicated, as determined by testing manufacturer's current standard products according to referenced procedures in CISCA A/F, "Recommended Test Procedures for Access Floors":
a. Concentrated Loads: Provide floor panels, including those with cutouts, capable of withstanding a concentrated design load of 1000 lbf (4448 N) **OR** 1250 lbf (5560 N) **OR** 1500 lbf (6672 N) **OR** 2000 lbf (8896 N), **as directed**, with a top-surface deflection under load and a permanent set not to exceed, respectively, 0.10 and 0.010 inch (2.54 and 0.25 mm) **OR** 0.080 inch and 0.010 inch (2.03 and 0.25 mm), **as directed**, according to CISCA A/F, Section I, "Concentrated Loads."
OR
Concentrated Loads: Provide floor panels, including those with cutouts, capable of withstanding a concentrated design load of 1000 lbf (4448 N) **OR** 1250 lbf (5560 N) **OR** 1500 lbf (6672 N) **OR** 2000 lbf (8896 N), **as directed**, with a bottom-surface deflection under load and a permanent set not to exceed, respectively, 0.10 and 0.010 inch (2.54 and 0.25 mm) **OR** 0.13 inch and 0.010 inch (3.30 and 0.25 mm), **as directed**, measured below each applied-load location at horizontal surface of nearest composite beam according to CISCA A/F, Section I, "Concentrated Loads."
b. Ultimate Loads: Provide access flooring systems capable of withstanding a minimum ultimate concentrated load of 2000 lbf (8896 N) **OR** 2500 lbf (11 121 N) **OR** 2600 lbf (11 565 N) **OR** 3000 lbf (13 345 N) **OR** 4000 lbf (17 793 N), **as directed**, without failing, according to CISCA A/F, Section II, "Ultimate Loading."
c. Rolling Loads: Provide access flooring systems capable of withstanding rolling loads of the following magnitude, with a combination of local and overall deformation not to exceed 0.040 inch (1.02 mm) after exposure to rolling load over CISCA A/F Path A or B, whichever path produces the greatest top-surface deformation, according to CISCA A/F, Section III, "Rolling Loads."
1) CISCA A/F Wheel 1 Rolling Load: 600 lbf (2669 N) **OR** 800 lbf (3559 N) **OR** 1000 lbf (4448 N) **OR** 1200 lbf (5338 N), **as directed**.

2) CISCA A/F Wheel 2 Rolling Load: 500 lbf (2224 N) **OR** 600 lbf (2669 N) **OR** 800 lbf (3559 N) **OR** 1000 lbf (4448 N), **as directed**.

d. Stringer Load Testing: Provide stringers, without panels in place, capable of withstanding a concentrated load of 75 lbf (334 N) **OR** 225 lbf (1001 N) **OR** 450 lbf (2002 N) **OR** 850 lbf (3781 N), **as directed**, at center of span with a permanent set not to exceed 0.010 inch (0.25 mm), as determined per CISCA A/F, Section IV, "Stringer Load Testing."

e. Pedestal Axial Load Test: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding a 5000 lbf (22 240 N) **OR** 6000 lbf (26 690 N), **as directed**, axial load per pedestal, according to CISCA A/F, Section V, "Pedestal Axial Load Test."

f. Pedestal Overturning Moment Test: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding an overturning moment per pedestal of 1000 lbf x inches (113 N x meters), according to CISCA A/F, Section VI, "Pedestal Overturning Moment Test."

2. Floor Panel Impact-Load Performance: Provide access flooring system capable of withstanding an impact load of 75 lb (34.0 kg) **OR** 100 lb (45.5 kg) **OR** 125 lb (56.7 kg) **OR** 150 lb (68.0 kg) **OR** 175 lbs (79.4 kg), **as directed**, when dropped from 36 inches (914 mm) onto a 1-sq. in. (6.5-sq. cm) area located anywhere on panel, without failing. Failure is defined as collapse of access flooring system.

3. Seismic Performance: Provide access flooring system capable of withstanding the effects of seismic motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

4. ESD-Control Properties: Provide floor coverings with ESD-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

a. Static-Dissipative Floor Covering Properties:

1) Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage **OR** ESD STM 7.1, **as directed**.

a) Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.

b) Average no less than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.

2) Static Generation: Less than 300 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.

3) Static Decay: 5000 to 0 V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.

b. Static-Conductive Floor Covering Properties:

1) Electrical Resistance: Test per ASTM F 150 with 500-V applied voltage **OR** ESD STM 7.1 **OR** NFPA 99, Annex 2 **OR** UL 779, **as directed**.

a) Average greater than 25,000 ohms and less than 1 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).

b) Average no less than 25,000 ohms with no single measurement less than 10,000 ohms when installed floor coverings are tested surface to ground.

2) Static Generation: Less than 100 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.

3) Static Decay: 5000 to 0 V in less than 0.03 **OR** 0.01, **as directed**, seconds when tested per FED-STD-101C/4046.1.

c. Antistatic Floor Covering Properties:

1) Electrical Resistance: Test per ESD STM 7.1.

a) Average greater than 25,000 ohms and less than 1,000 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).

2) Static Generation: Less than 100 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.

d. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.

F. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Include layout of access flooring system and relationship to adjoining Work based on field-verified dimensions.
3. Shop Drawings: Include layout, details, sections, and relationship to adjoining Work.
4. LEED Submittals:
a. Product Data for Credit EQ 4.1: For pedestal installation adhesive, including printed statement of VOC content.
b. Product Data for Credit EQ 4.3: For carpet and installation adhesive, documentation indicating compliance with specified requirements.
c. Product Data for Credit EQ 4.4: For particleboard used in steel-encapsulated, wood core panels, documentation indicating that particleboard contains no urea formaldehyde.
5. Product test reports.

G. Quality Assurance
1. Regulatory Requirements: Fabricate and install access flooring to comply with NFPA 75 requirements for raised flooring.
2. Preinstallation Conference: Conduct conference at Project site.

1.2 PRODUCTS

A. Floor Panels And Understructure
1. Floor Panels, General: Provide modular panels complying with the following requirements that one person, using a portable lifting device, can interchange with other field panels without disturbing adjacent panels or understructure:
a. Nominal Panel Size: 24 by 24 inches (610 by 610 mm) **OR** 600 by 600 mm, **as directed**.
b. Fabrication Tolerances: Fabricate panels to the following tolerances with squareness tolerances expressed as the difference between diagonal measurements from corner to corner:
1) Size and Squareness: Plus or minus 0.015 inch (0.38 mm) of required size, with a squareness tolerance of plus or minus 0.015 inch (0.38 mm), unless tolerances are otherwise indicated for a specific panel type.
2) Flatness: Plus or minus 0.020 inch (0.50 mm), measured on a diagonal on top of panel.
c. Panel Attachment to Understructure: By gravity.
d. Panel Attachment to Understructure: By bolting to pedestal head. Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
1) Provide fasteners held captive to panels.
2. Steel-Encapsulated, Wood-Core Panels: Fabricated with 1-inch- (25-mm-) thick, particleboard core, made without urea formaldehyde laminated to top and bottom steel face sheets, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish, and with a flame-spread index of 25 or less per ASTM E 84. Provide core edges enclosed with upturned, die-formed edge of bottom sheet or with perimeter steel channel welded to top sheet and welded or bonded to bottom sheet.
3. Formed-Steel Panels: Fabricated with die-cut flat top sheet and die-formed and stiffened steel bottom pan formed from cold-rolled steel sheet and joined together by resistance welding, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish to produce units of the following type:
a. Solid Panels: Flat, solid top surface.

b. Perforated Panels: Perforated top surface with holes **OR** slots, **as directed**, of number, spacing, and size standard with manufacturer to produce a nominal open area of 25 percent. Provide mechanical dampers with each panel unit, **as directed**.
   1) Quantity: As directed.
   2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.

c. Grates: Grating ribs arranged in manufacturer's standard pattern to produce a nominal open area of 56 percent. Provide mechanical dampers with each panel unit, **as directed**.
   1) Quantity: As directed.
   2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.

4. Cementitious-Filled, Formed-Steel Panels: Fabricated with die-cut flat top sheet and die-formed and stiffened bottom pan formed from cold-rolled steel sheet joined together by resistance welding to form an enclosed assembly, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.
5. Die-Cast Aluminum Panels: Fabricated from manufacturer's standard aluminum alloy but not less than the strength and corrosion resistance of Alloy UNS No. A03830 or UNS No. A03840 per ASTM B 85, to produce units of the following type and with the following finish:
   a. Solid Panels: Flat, solid surface on top and symmetrical crossing ribs on bottom; edge machined after casting to specified tolerances.
   b. Perforated Panels: Perforated top surface with holes **OR** slots, **as directed**, of number, spacing, and size standard with manufacturer to produce a nominal open area of 25 percent. Provide mechanical dampers with each panel unit, **as directed**.
      1) Quantity: As directed.
      2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.
   c. Grates: Grating ribs arranged in manufacturer's standard pattern to produce a nominal open area of 56 percent. Provide mechanical dampers with each panel unit, **as directed**.
      1) Quantity: As directed.
      2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.
   d. Epoxy Finish: Epoxy **OR** Conductive epoxy, **as directed**, powder coating with a minimum average thickness of 2.5 mils (0.064 mm) and in color selected from manufacturer's full range.
   e. Plated Finish: Nickel-chrome electrodeposited plating, 0.000005-inch (0.000127-mm) chrome over 0.0008-inch (0.02-mm) nickel, without copper or brass strike, to produce complete coverage over significant surfaces with a matte metallic appearance.
6. Concrete-Filled, Steel Pan Panels: Fabricated with bottom pan die-formed from electrolytic-zinc-coated steel sheet and filled with lightweight concrete that is reinforced and bonded to pan by shear ties.
7. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap); made of steel **OR** aluminum, **as directed**.
   a. Provide pedestals designed for use in seismic applications.
   b. Base: Square or circular base with not less than 16 sq. in. (103 sq. cm) of bearing area.
   c. Column: Of height required to bring finished floor to elevations indicated. Weld to base plate.
   d. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches (51 mm) and for locking at a selected height, so deliberate action is required to change height setting and vibratory displacement is prevented.
   e. Head: Designed to support understructure system indicated.
      1) Provide sound-deadening pads or gaskets at contact points between heads and panels.
      2) Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals.
8. Stringer Systems: Modular steel **OR** aluminum, **as directed**, stringer systems made to interlock with pedestal heads and form a grid pattern placing stringers under each edge of each floor panel

and a pedestal under each corner of each floor panel. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.

a. Bolted Stringers: System of main and cross stringers connected to pedestals with threaded fasteners accessible from above.
b. Snap-on Stringers: System of stringers attached to pedestals with nonbolted interlocking connections to provide a stable understructure and to prevent accidental disengagement.
c. Provide continuous gasket at contact surfaces between panel and stringers to deaden sound, to seal off underfloor cavity from above, and to maintain panel alignment and position.
d. Provide stringers that support each edge of each panel where required to meet design-load criteria.

B. Floor Panel Coverings

1. Provide bare panels without factory-applied floor coverings on traffic surfaces.
2. General: Provide factory-applied floor coverings of type indicated that are laminated by access flooring manufacturer to tops of floor panels including perforated panels, **as directed**.
3. Colors, Textures, and Patterns: As selected from manufacturer's full range.
4. Standard Plastic Laminate: NEMA LD 3, High-Wear type, Grade HWH **OR** HDS, **as directed**; fabricated in one piece to cover each panel face within perimeter plastic **OR** with integral trim serving as, **as directed**, edging.
5. Static-Conductive Plastic Laminate: NEMA LD 3, High-Wear type, Grade CHWH **OR** CHDS, **as directed**, fabricated in one piece to cover each panel face within perimeter plastic edging or with integral trim serving as edging.
6. Solid Vinyl Tile: Static-Conductive **OR** Static-Dissipative, **as directed**, ASTM F 1700, Class I (Monolithic Vinyl Tile), Type A (Smooth Surface), fabricated in one piece to cover panel face within plastic edging.
7. Low-Emissivity, Solid Vinyl Tile: Static-Conductive **OR** Static-Dissipative, **as directed**, ASTM F 1700, Class I (Monolithic Vinyl Tile), Type A (Smooth Surface), with minimum 50 percent reduction in outgasing **OR** total mass loss of 1 percent and minimum 98 percent reduction in collected volatile condensable materials, **as directed**, compared to products with dioctyl phthalate as determined by testing per ASTM E 595.
8. Standard Commercial Carpet: Die cut and adhesively bonded to top surface of panel.
   a. Provide factory-applied carpet with the following characteristics:
      1) Style: Passport.
      2) Fiber Type: 100% BCF nylon.
      3) Pile Characteristics: Level loop.
      4) Pile Thickness: 0.130 inch (3.30 mm).
      5) Stitches: 10.0/inch (10.0/2.54 cm).
      6) Surface Pile Weight: 26 oz./sq. yd. (881 g/sq. m).
      7) Total Weight: 56 oz./sq. yd. (1899 g/sq. m).
      8) Backing: Woven polypropylene.
      9) Critical Radiant Flux Rating: Minimum of 0.45 W/sq. cm per ASTM E 648.
   b. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program. Bond carpet to panels with adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
9. Antistatic Carpet: Antistatic modular carpet tile bonded with conductive adhesive to **OR** with buttons that engage into positioning holes in, **as directed**, top surface of panel.
   a. Provide carpet with the following characteristics:
      1) Style: Classic **OR** Contempo, **as directed**.
      2) Fiber Type: Solutia LXI nylon **OR** Performa SD Type 6 nylon, **as directed**
      3) Pile Characteristics: Textured loop **OR** Textured graphic loop, **as directed**.
      4) Pile Thickness: 0.125 and 0.188 inch (3.18 and 4.78 mm).
      5) Stitches: 11.0/inch (11.0/2.54 cm) **OR** 10.0/inch (10.0/ 2.54 cm), **as directed**.
      6) Surface Pile Weight: 24 oz./sq. yd. (814 g/sq. m).
      7) Total Weight: 148 oz./sq. yd. (5018 g/sq. m).

8) Backing: Static-dissipative, unitary PVC backing with conductive additive.
9) Critical Radiant Flux Rating: Minimum of 0.45 W/sq. cm per ASTM E 648.

b. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program. Bond carpet to panels with adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24), **as directed**.

10. Edging: Manufacturer's standard applied **OR** integral, **as directed**, edge trim. Provide size and profile of applied edge trim that fits floor coverings selected.
11. Resilient Wall Base: ASTM F 1861, Type TS (rubber, vulcanized thermoset) **OR** TV (vinyl, thermoplastic), **as directed**, Group 1 (solid), Style B (cove), 0.080 inch (2.03 mm) **OR** 0.125 inch (3.18 mm), **as directed**, thick and 2-1/2 inches (63.5 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**, high, with matching end stops and factory-made corner units, **as directed**.

C. Accessories
1. Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.
   a. Provide adhesive with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Post-Installed Anchors: For anchoring pedestal bases to subfloor, provide 2 **OR** 4, **as directed**, post-installed expansion anchors **OR** threaded concrete screws, **as directed**, made from carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild), with the capability to sustain, without failure, a load equal to 1.5 times the loads imposed by pedestal overturning moment on fasteners, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
3. Cutouts: Provide cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with standard performance requirements.
   a. Number, Size, Shape, and Location: As directed.
   b. Trim edge of cutouts with manufacturer's standard plastic molding.
   c. Fit cutouts with manufacturer's standard grommets in sizes indicated or, if size of cutouts exceeds maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding having tapered top flange. Furnish removable covers for grommets, **as directed**.
   d. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.
4. Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels, for power, communication, and signal services, and complying with the following requirements:
   a. Structural Performance: Cover capable of supporting a 1000-lbf (4448-N) concentrated load.
   b. Cover and Box Type: Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles.

      OR

      Cover and Box Type: Grommet with twist-close cover and including steel junction box for electrical receptacle with provision for telephone Amphenol connectors and signal cables.
   c. Location: In center of panel quadrant, unless otherwise indicated.
   d. Receptacles and Wiring: Electrical receptacles and wiring for service outlets are specified in Division 22.

      OR

      Receptacles and Wiring: Equip each service outlet with power receptacles to comply with the following requirements:
      1) Type of Receptacle: Heavy-duty duplex, 2-pole, 3-wire grounding, 20 A, 125 V, NEMA WD 6, Configuration 5-20R, unless otherwise indicated.
      2) Number of Receptacles for Outlet: One **OR** Two **OR** Four, **as directed**.

3) Wiring Method: Factory wired for hard wiring in field with armored cable, containing 3 insulated No. 12 AWG solid-copper conductors, terminated with a 6-inch- (152-mm-) long pigtail.
OR
Wiring Method: Power-in connectors, built into outlet housing, of type to fit power-in and power-out connectors of branch-circuit cables supplied with building electrical system.

5. Diffusers: Manufacturer's standard round diffusers, 4 inches (102 mm) **OR** 8 inches (203 mm), **as directed**, in diameter, formed from aluminum **OR** polycarbonate plastic, **as directed**, to produce a removable 1-piece unit complete with diffuser, manually adjustable flow regulator, dirt and dust receptacle, trim ring, and underfloor compression mounting ring; precisely fitted in factory-prepared openings of standard field panels, and complying with the following requirements:
   a. Air-Distribution Characteristics: 100 cfm (47 L/s) at 0.096-inch (24-Pa) static pressure and a maximum noise criterion rating of 15, **as directed**.
   b. Structural Performance: Capable of supporting a 600-lbf (2669-N) concentrated load, **as directed**.
   c. Fire-Test-Response Characteristics: Classified 94V-0 per UL 94.
6. Floor Grilles: Standard load-bearing grilles formed from aluminum **OR** polycarbonate plastic, **as directed**, to produce removable one-piece unit precisely fitted in factory-prepared openings of standard field panels, with adjustable/removable **OR** without, **as directed**, dampers and complying with the following requirements:
   a. Air-Distribution Characteristics: 468 cfm at 0.10-inch wg (221 L/s at 25-Pa) static pressure.
   b. Structural Performance: Capable of supporting a 1000-lbf (4448-N) concentrated load.
   c. Fire-Test-Response Characteristics: Classified 94V-0 per UL 94.
7. Cavity Dividers: Provide manufacturer's standard metal dividers located where indicated to divide underfloor cavities.
8. Vertical Closures (Fasciae): Where underfloor cavity is not enclosed by abutting walls or other construction, provide metal-closure plates with manufacturer's standard finish.
9. Ramps: Manufacturer's standard ramp construction of width and slope indicated but not steeper than 1:12, with raised-disc or textured rubber or vinyl floor coverings, and of same materials, performance, and construction requirements as access flooring.
10. Steps: Provide steps of size and arrangement indicated with floor coverings to match access flooring. Apply nonslip aluminum nosings to treads, unless otherwise indicated.
11. Railings: Standard extruded-aluminum railings, at ramps and open-sided perimeter of access flooring where indicated. Include handrail, intermediate rails, posts, brackets, end caps, wall returns, wall and floor flanges, plates, and anchorages where required.
    a. Provide railings that comply with structural performance requirements specified in Division 05 Section(s) "Pipe And Tube Railings" OR "Decorative Metal", **as directed**.
12. Panel Lifting Device: Manufacturer's standard portable lifting device of type required for specified panels. Provide one lifting devices per room of each type required.
13. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

1.3 EXECUTION

A. Preparation

1. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches (152 mm).
2. Locate each pedestal, complete any necessary subfloor preparation, and vacuum clean subfloor to remove dust, dirt, and construction debris before beginning installation.

B. Installation

1. Install access flooring system and accessories under supervision of access flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.
2. Set pedestals in adhesive as recommended in writing by access flooring manufacturer to provide full bearing of pedestal base on subfloor.
3. Attach pedestals to subfloor by post-installed mechanical anchors.
4. Adjust pedestals to permit top of installed panels to be set flat, level, and to proper height.
5. Secure stringers to pedestal heads according to access flooring manufacturer's written instructions.
6. Install flooring panels securely in place, properly seated with panel edges flush. Do not force panels into place.
   a. Carpeted Panels: Install panels with carpet pile in same direction.
7. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch (3 mm) where panels abut vertical surfaces.
   a. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by panel manufacturer.
8. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under access flooring already installed.
9. Ground flooring system as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
10. Scribe and install underfloor-cavity dividers to closely fit against subfloor surfaces, and seal with mastic.
11. Scribe vertical closures to closely fit against subfloor and adjacent finished-floor surfaces. Set in mastic and seal to maintain plenum effect within underfloor cavity.
12. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area, as installation of floor panels proceeds.
13. Seal underfloor air cavities at construction seams, penetrations, and perimeter to control air leakage as recommended in writing by manufacturer.
14. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
    a. Plus or minus 1/16 inch (1.5 mm) **OR** 1/8 inch (3 mm), **as directed**, in any 10-foot (3-m) distance.
    b. Plus or minus 1/8 inch (3 mm) **OR** 1/4 inch (6.5 mm), **as directed**, from a level plane over entire access flooring area.

C. Adjusting, Cleaning, And Protection
1. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation to allow pedestal adhesive to set.
2. After completing installation, vacuum clean access flooring and cover with continuous sheets of reinforced paper or plastic. Maintain protective covering until time of Final Completion.
3. Replace access flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION 09 69 13 00

Task	Specification	Specification Description
09 69 53 00	09 69 13 00	Access Flooring

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SECTION 09 72 13 00 - WALL COVERINGS

1.1 GENERAL

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

B. Summary
1. Section Includes:
a. Vinyl wall covering.
b. Woven glass-fiber wall covering.
c. Textile wall covering.
d. Heavy-duty synthetic textile wall covering.
e. Wood-veneer wall covering.
f. Wallpaper.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood-veneer wall coverings comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
c. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content and chemical components.
3. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, veneer matching, seams and termination points.
4. Samples: Full width by 36-inch- (914-mm-) long section of wall covering from same print run or dye lot to be used for the Work, with specified treatments, paint, applied. Show complete pattern repeat. Mark top and face of fabric.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
6. Maintenance Data: For wall coverings to include in maintenance manuals.

D. Quality Assurance
1. Forest Certification: Fabricate products with wood veneer produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Surface-Burning Characteristics: As follows, per ASTM E 84:
1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
b. Fire-Growth Contribution: Textile wall coverings complying with acceptance criteria of IBC Standard 803.
c. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 **OR** NFPA 286, **as directed**, and complying with test protocol and criteria in the IBC Standard 803.

E. Project Conditions
1. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   a. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.
2. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
3. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.2 PRODUCTS

A. Wall Coverings
1. General: Provide rolls of each type of wall covering from same print run or dye lot.

B. Vinyl Wall Covering
1. Vinyl Wall-Covering Standards: Provide products **OR** mildew-resistant products, **as directed**, complying with the following:
   a. FS CCC-W-408D and CFFA-W-101-D for Type I, Light-Duty **OR** Type II, Medium-Duty **OR** Type III, Heavy-Duty, **as directed**, products.
   b. ASTM F 793 for peelable **OR** strippable, **as directed**, wall coverings that qualify as Category I, Decorative Only **OR** Category II, Decorative with Medium Serviceability **OR** Category III, Decorative with High Serviceability **OR** Category IV, Type I, Commercial Serviceability **OR** Category V, Type II, Commercial Serviceability **OR** Category VI, Type III, Commercial Serviceability, **as directed**, products.
2. Width: 27 inches (686 mm) **OR** 54 inches (1372 mm), **as directed**.
3. Backing: Scrim **OR** Osnaburg **OR** Drill **OR** Nonwoven, **as directed**, fabric.
   a. Fiber Content: Cotton **OR** Polyester **OR** Polycotton **OR** Polyester cellulose, **as directed**.
4. Repeat: Random.
5. Colors, Textures, and Patterns: As selected from manufacturer's full range.

C. Woven Glass-Fiber Wall Covering
1. Width: 39 inches (991 m).
2. Colors, Textures, and Patterns: As selected from manufacturer's full range.

D. Textile Wall Covering
1. Wall-Covering Standard: Provide mildew-resistant **OR** peelable **OR** strippable, **as directed**, wall coverings that comply with ASTM F 793 for Category I, Decorative Only **OR** Category II, Decorative with Medium Serviceability **OR** Category III, Decorative with High Serviceability **OR** Category IV, Type I, Commercial Serviceability **OR** Category V, Type II, Commercial Serviceability **OR** Category VI, Type III, Commercial Serviceability, **as directed**, products.
2. Test Responses:
   a. Colorfastness to Wet and Dry Crocking: Passes AATCC 8, Grade 3, minimum.
   b. Colorfastness to Light: Passes AATCC 16, Option 1 or 3, Grade 4, minimum, at 40 hours.
3. Repeat: Random.
4. Applied Backing Material: Acrylic **OR** Paper, **as directed**.
5. Colors, Textures, and Patterns: As selected from manufacturer's full range.

E. Heavy-Duty Synthetic Textile Wall Covering
1. Wall-Covering Standard: Provide wall coverings **OR** mildew-resistant wall coverings, **as directed**, that comply with ASTM F 793 for Category IV, Type I, Commercial Serviceability **OR**

Category V, Type II, Commercial Serviceability **OR** Category VI, Type III, Commercial Serviceability, **as directed**, products.

2. Test Responses:
   a. Colorfastness to Wet and Dry Crocking: Passes AATCC 8, Class 3, minimum.
   b. Colorfastness to Light: Passes AATCC 16A or AATCC 16E, Class 4, minimum, at 40 hours.
3. Width: 54 inches (1372 mm) **OR** 60 inches (1524 mm), **as directed**.
4. Colors, Textures, and Patterns: As selected from manufacturer's full range.

F. Wood-Veneer Wall Covering
1. Sheet Size: 24 by 96 inches (610 by 2440 mm) **OR** 48 by 96 inches (1220 by 2440 mm) **OR** 48 by 120 inches (1220 by 3050 mm), **as directed**.
2. Veneer Construction: Single ply veneer **OR** Two veneer plies assembled perpendicular to one another, **as directed**.
3. Wood Species: Red oak **OR** Maple **OR** Cherry, **as directed**.
4. Veneer Match: Book **OR** Slip, **as directed**.
5. Sheet Match: Running **OR** Balance **OR** Center **OR** Sequence, as indicated **OR** Blueprint, as indicated, **as directed**.
6. Applied Backing Material: Fabric.
7. Finish: Factory **OR** Field, **as directed**, applied using wall-covering manufacturer's standard stain and polyurethane system.
   a. Colors: As selected from manufacturer's full range.

G. Wallpaper
1. Wall-Covering Standard: Provide mildew-resistant **OR** peelable **OR** strippable, **as directed**, wallpaper that complies with ASTM F 793 for Category I, Decorative Only **OR** Category II, Decorative with Medium Serviceability **OR** Category III, Decorative with High Serviceability, **as directed**, products.
2. Width: 20-1/2 inches (520.7 mm) **OR** 28 inches (711.2 mm), **as directed**.
3. Repeat: Random.
4. Colors, Textures, and Patterns: As selected from manufacturer's full range.

H. Accessories
1. Adhesive: Mildew-resistant, nonstaining, strippable, **as directed**, adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Primer/Sealer: Mildew resistant, complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.
3. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.
4. Seam Tape: As recommended in writing by wall-covering manufacturer.
5. Metal Primer: Interior ferrous metal primer complying with Division 09 Section "Interior Painting".

1.3 EXECUTION

A. Preparation
1. Comply with manufacturer's written instructions for surface preparation.
2. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
3. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   a. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.

b. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
c. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
d. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
e. Painted Surfaces: Treat areas susceptible to pigment bleeding.

4. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
5. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
6. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
7. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

B. Installation
1. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
2. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
3. Install strips in same order as cut from roll.
4. Install reversing every other strip.
5. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
6. Match pattern 72 inches (1830 mm) above the finish floor.
7. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) **OR** 6 inches (150 mm), **as directed**, from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
8. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
9. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

C. Field Finishing Of Wood-Veneer Wall Coverings
1. Apply wall-covering manufacturer's standard stain and polyurethane system according to coating manufacturer's written instructions to produce finish that is consistent in color and gloss and matches approved Samples.
2. Apply no fewer than two **OR** three, **as directed**, finish coats.

D. Cleaning
1. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
2. Use cleaning methods recommended in writing by wall-covering manufacturer.
3. Replace strips that cannot be cleaned.
4. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 13 00

Task	Specification	Specification Description
09 72 16 13	09 72 13 00	Wall Coverings
09 72 23 00	09 72 13 00	Wall Coverings
09 73 00 00	09 01 60 91a	Carpet
09 81 16 00	09 84 13 00	Acoustical Wall Panels

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SECTION 09 84 13 00 - ACOUSTICAL WALL PANELS

1.1 GENERAL

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

B. Summary
1. This Section includes spline-mounted **OR** back-mounted, **as directed**, acoustical wall panels.

C. Definitions
1. NRC: Noise reduction coefficient.

D. Submittals
1. Product Data: For each type of panel edge, core material, and mounting indicated.
2. Shop Drawings: For acoustical wall panels. Include mounting devices and details.
3. Coordination Drawings: Show intersections with adjacent work.
4. Samples: For each fabric and sample panels.
5. LEED Submittal:
   a. Product Data for Credit EQ 4.1: For installation adhesive, including printed statement of VOC content.
6. Product certificates **OR** test reports, **as directed**.
7. Maintenance data.
8. Warranty: Special warranty specified in this Section.

E. Quality Assurance
1. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 **OR** IBC Chapter 8, **as directed**, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 **OR** NFPA 286, **as directed**.
3. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
2. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.
3. Protect panel edges from crushing and impact.

G. Project Conditions
1. Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
2. Lighting: Do not install acoustical wall panels until a permanent level of lighting **OR** a lighting level of not less than 50 fc (538 lux), **as directed**, is provided on surfaces to receive acoustical wall panels.

3. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
4. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within two years from date of Final Completion.
   a. Failure in performance includes, but is not limited to, acoustical performance.
   b. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.

1.2 PRODUCTS

A. Core Materials
1. Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
2. Mineral-Fiber Board: Maximum flame-spread and smoke-developed indexes of 15 and 5, respectively.
3. Cementitious-Fiber Board Core: Density of not less than 20 lb/cu. ft. (320 kg/cu. m).
4. Tackable, Impact-Resistant, High-Density Face Layer: 1/8-inch- (3.2-mm-) thick layer of compressed molded glass-fiber board with a minimum nominal density of 16 to 18 lb/cu. ft. (256 to 288 kg/cu. m) laminated to face of core.
5. Impact-Resistant, Acoustically Transparent, Copolymer Face-Sheet Layer for High-Abuse Applications: 1/16- to 1/8-inch- (1.6- to 3.2-mm-) thick layer of perforated, noncombustible, copolymer sheet laminated to face of core.
6. Wood: Clear, vertical grain, straight, kiln-dried hardwood of manufacturer's standard species, AWPA C20, Interior Type A, fire-retardant treated, low-hygroscopic-type formulation. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment to 5 to 10 percent moisture content.

B. Spline-Mounted Acoustical Wall Panels With Perforated Mineral-Fiber Board Core Or Cementitious-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a perforated, water-felted, mineral-fiber board **OR** cementitious-fiber board, **as directed**, core; with long edges kerfed and rabbeted to receive splines.
   a. Mineral-Fiber Board: Not less than 13-lb/cu. ft. (208-kg/cu. m) **OR** 20-lb/cu. ft. (320-kg/cu. m), **as directed**, nominal density; with perforated surface.
2. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
   a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
   b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
   c. Applied Treatments: Stain resistance.
3. Nominal Overall Panel Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
4. NRC: For Type A mounting per ASTM E 795, NRC 0.50 to NRC 0.90 **OR** NRC 0.60 to NRC 0.70 **OR** NRC 0.65 to NRC 0.75, **as directed**.
5. Panel Width: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** As indicated on Drawings, **as directed**.
6. Panel Height: Fabricated from units 96 inches (2438 mm) **OR** 108 inches (2743 mm) **OR** 120 inches (3048 mm), **as directed**, in height; mounting height **as directed**.

7. Panel Edge: Core self-edge.
8. Panel Short Edge Detail: Square.

C. Spline-Mounted Acoustical Wall Panels With Glass-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a dimensionally stable, rigid glass-fiber board core with a nominal density of 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m); with long edges kerfed and rabbeted to receive splines.
2. Core-Face Layer: Tackable, impact-resistant, high-density board **OR** Impact-resistant, acoustically transparent, copolymer face-sheet, **as directed**.
3. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
   a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
   b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
   c. Applied Treatments: Stain resistance.
4. Nominal Overall Panel Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**.
5. NRC: For Type A mounting per ASTM E 795, not less than NRC 0.20 **OR** NRC 0.80 **OR** NRC 0.95, **as directed**.
6. Panel Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** 1200 mm **OR** As indicated on Drawings, **as directed**.
7. Panel Height: Fabricated from units 96 inches (2438 mm) **OR** 108 inches (2743 mm) **OR** 120 inches (3048 mm), **as directed**, in height; mounting height **as directed**.
8. Panel Edge: Manufacturer's standard short edge.
9. Panel Short Edge Detail: Square.

D. Back-Mounted Acoustical Wall Panels With Perforated Mineral-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a perforated, water-felted, mineral-fiber board core of not less than 13-lb/cu. ft. (208-kg/cu. m) **OR** 20-lb/cu. ft. (320-kg/cu. m), **as directed**, nominal density; with perforated surface.
2. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
   a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
   b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
   c. Applied Treatments: Stain resistance.
3. Nominal Core Thickness and Overall System NRC: 1/2 inch (13 mm) and not less than NRC 0.35 **OR** 3/4 inch (19 mm) and not less than NRC 0.45, **as directed**, for Type A mounting.
4. Panel Width: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** As indicated on Drawings, **as directed**.
5. Panel Height: Fabricated from units 96 inches (2438 mm) **OR** 108 inches (2743 mm) **OR** 120 inches (3048 mm), **as directed**, in height; mounting height **as directed**.
6. Panel Edge: Core self-edge.
7. Panel Short Edge Detail: Square.

E. Back-Mounted, Edge-Reinforced Acoustical Wall Panels With Glass-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber **OR** rock-fiber/slag-fiber, **as directed**, board core; with edges chemically hardened or impact resistant and resilient to reinforce panel perimeter against warpage and damage.
2. Nominal Core Density: 4 to 7 lb/cu. ft. (64 to 112 kg/cu. m) **OR** 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), **as directed**.

3. Core-Face Layer: Tackable, impact-resistant, high-density board **OR** Impact-resistant, acoustically transparent, copolymer face-sheet, **as directed**.
4. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
   a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
   b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
   c. Applied Treatments: Stain resistance.
5. Nominal Core Thickness and Overall System NRC: 3/4 inch (19 mm) and not less than NRC 0.65 **OR** 1 inch (25 mm) and not less than NRC 0.80 **OR** 1-1/2 inches (38 mm) and not less than NRC 0.85 **OR** 2 inches (51 mm) and not less than NRC 0.90 **OR** 2 inches (51 mm) and not less than NRC 1.00, **as directed**, for Type A mounting per ASTM E 795.
6. Panel Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** 1200 mm **OR** As indicated on Drawings, **as directed**.
7. Panel Height: Fabricated height as indicated on Drawings **OR as directed**; mounting height as indicated on Drawings **OR as directed**.
8. Panel Edge Detail: Square **OR** Bullnosed (radiused) **OR** Chamfered (beveled) **OR** Mitered **OR** Custom as indicated on Drawings, **as directed**.
9. Corner Detail: Square **OR** Round, radius as indicated **OR** Off-square, dimensions as indicated, **as directed**, to form continuous profile to match edge detail.

F. Back-Mounted, Edge-Framed Acoustical Wall Panels With Glass-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed, dimensionally stable, rigid glass-fiber board core and bonded or attached to edges and back of frame.
2. Nominal Core Density: 4 to 7 lb/cu. ft. (64 to 112 kg/cu. m) **OR** 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), **as directed**.
3. Core-Face Layer: Tackable, impact-resistant, high-density board **OR** Impact-resistant, acoustically transparent, copolymer face-sheet, **as directed**.
4. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
   a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
   b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
   c. Applied Treatments: Stain resistance.
5. Nominal Core Thickness and Overall System NRC: 1 inch (25 mm) and not less than NRC 0.80 **OR** 1-1/2 inches (38 mm) and not less than NRC 0.85 **OR** 2 inches (51 mm) and not less than NRC 0.90, **as directed**, for Type A mounting per ASTM E 795.
6. Panel Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** 1200 mm **OR** As indicated on Drawings, **as directed**.
7. Panel Height: Fabricated height as indicated on Drawings **OR as directed**; mounting height as indicated on Drawings **OR as directed**.
8. Panel Edge and Frame: Extruded-aluminum or zinc-coated, rolled-steel shape **OR** Extruded PVC **OR** Hardwood, rabbeted, and splined with glued joints and machined corners, **as directed**.
   a. Panel Edge Detail: Square.

G. Fabrication
1. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.
2. Acoustical Wall Panels: Panel construction consisting of facing material adhered to face, **as directed**, edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.
   a. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.

3. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.
   a. Where square corners are indicated, tailor corners. Heat seal vinyl fabric seams at corners.
   b. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.
   c. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
4. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, sags.
5. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
   a. Thickness.
   b. Edge straightness.
   c. Overall length and width.
   d. Squareness from corner to corner.
   e. Chords, radii, and diameters.
6. Spline-Mounting Accessories: Manufacturer's standard concealed, extruded-aluminum or plastic connecting splines designed and fabricated for screw attachment to walls, with other moldings and trim for interior and exterior corners, leveling and base support with factory-applied finish on exposed items.
   a. Finish Color: White **OR** Black **OR** Match color of facing material **OR** Match sample, **as directed**.
7. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, with base-support bracket system where recommended by manufacturer for additional support of panels, and as follows:
   a. Adhesive. Use only adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Hook-and-loop tape.
   c. Impaling clips.
   d. Magnetic strip or devices.
   e. Metal "Z" Clips: Two-part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to allow for panel removal.
   f. As recommended by manufacturer.
8. Owner-Furnished Fabric: Provide fabric acceptable to acoustical wall panel manufacturer for application indicated. Notify the Owner of fabric unacceptability.

1.3 EXECUTION

A. Installation

1. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
   a. Cut units to be at least 50 percent of unit width, with facing material extended over cut edge to match uncut edge. Scribe acoustical wall panels to fit adjacent work. Butt joints tightly.
2. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.
3. Match and level fabric pattern and grain among adjacent panels.
4. Installation Tolerances: As follows:
   a. Variation from Level and Plumb: Plus or minus 1/16 inch (1.6 mm).
   b. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) **OR** 1/32 inch (0.79 mm), **as directed**, wide.

B. Cleaning
   1. Clip loose threads; remove pills and extraneous materials.
   2. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

C. Protection
   1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Final Completion.
   2. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by the Owner, before time of Final Completion.

END OF SECTION 09 84 13 00

Task	Specification	Specification Description
09 84 13 00	09 28 13 00	Gypsum Board
09 84 13 00	09 23 13 00	Gypsum Board Renovation
09 84 13 00	09 28 13 00a	Gypsum Board Shaft-Wall Assemblies

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SECTION 09 91 13 00 - EXTERIOR PAINTING

1.1 GENERAL

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

B. Summary
1. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
   a. Concrete.
   b. Clay masonry.
   c. Concrete masonry units (CMU).
   d. Steel.
   e. Galvanized metal.
   f. Aluminum (not anodized or otherwise coated).
   g. Wood.
   h. Plastic trim fabrications.
   i. Exterior portland cement (stucco).
   j. Exterior gypsum board.

C. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For each finish and for each color and texture required.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.

D. Quality Assurance
1. MPI Standards:
   a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated. For renovation projects, comply with requirements of "MPI Maintenance Repainting Manual" for products and paint systems indicated.
2. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   a. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      2) Other Items: Architect will designate items or areas required.
   b. Final approval of color selections will be based on mockups.
      1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling
1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
a. Maintain containers in clean condition, free of foreign materials and residue.
b. Remove rags and waste from storage areas daily.

F. Project Conditions
1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Paint, General
1. Material Compatibility:
a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
2. Colors: As selected from manufacturer's full range.

B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI #4.
a. VOC Content: E Range of E2 **OR** E3, **as directed**.

C. Primers/Sealers
1. Alkali-Resistant Primer: MPI #3.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Bonding Primer (Water Based): MPI #17.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Bonding Primer (Solvent Based): MPI #69.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.

D. Metal Primers
1. Alkyd Anticorrosive Metal Primer: MPI #79.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Quick-Drying Alkyd Metal Primer: MPI #76.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Cementitious Galvanized-Metal Primer: MPI #26.
a. VOC Content: E Range of E1.
4. Waterborne Galvanized-Metal Primer: MPI #134.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
5. Quick-Drying Primer for Aluminum: MPI #95.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

E. Wood Primers
1. Exterior Latex Wood Primer: MPI #6.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Exterior Alkyd Wood Primer: MPI #5.

a. VOC Content: E Range of E2 **OR** E3, **as directed**.
3. Exterior Oil Wood Primer: MPI #7.
a. VOC Content: E Range of E2.

F. Exterior Latex Paints
1. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Exterior Alkyd Paints
1. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
a. VOC Content: E Range of E1.
2. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).
a. VOC Content: E Range of E1 **OR** E2, **as directed**.

H. Quick-Drying Enamels
1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
a. VOC Content: E Range of E1 **OR** E **OR** E3, **as directed**.

I. Textured And High-Build Coatings
1. Latex Stucco and Masonry Textured Coating: MPI #42.
a. VOC Content: E Range of E2 **OR** E3, **as directed**.
2. High-Build Latex (Exterior): MPI #40.
a. VOC Content: E Range of E1 **OR** E3, **as directed**.

J. Aluminum Paint
1. Aluminum Paint: MPI #1.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

K. Floor Coatings
1. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
a. VOC Content: E Range of E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 3.
4. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.

1.3 EXECUTION

A. Examination
1. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
2. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.
b. Masonry (Clay and CMU): 12 percent.
c. Wood: 15 percent.
d. Plaster: 12 percent.
e. Gypsum Board: 12 percent.

3. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
4. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   a. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

B. Preparation And Application
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
2. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
3. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
4. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
5. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

C. Exterior Painting Schedule
1. Paint systems herein are based on "MPI Architectural Painting Specification Manual" (hereafter, "MPI Manual"). For renovation projects, consult "MPI Maintenance Repainting Manual" and revise paint systems accordingly.
2. For a Premium Grade system, "MPI Manual" requires intermediate coat; if Custom Grade system is required or if so directed, delete intermediate coat, **unless directed otherwise** or as otherwise required by manufacturer's recommendations.
3. Concrete Substrates, Nontraffic Surfaces:
   a. Latex System: MPI EXT 3.1A.
      1) Prime Coat: Exterior latex matching topcoat.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Latex Aggregate/Latex System: MPI EXT 3.1 B.
      1) Prime Coat: Latex stucco and masonry textured coating.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. Latex Over Alkali-Resistant Primer System: MPI EXT 3.1K.
      1) Prime Coat: Alkali-resistant primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   d. High-Build Latex System: MPI EXT 3.1L, applied to form dry film thickness of not less than 10 mils (0.25 mm).
      1) Prime Coat: As recommended in writing by topcoat manufacturer.
      2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
      3) Topcoat: High-build latex (exterior).
   e. Latex Aggregate System: MPI EXT 3.1N.
      1) Prime Coat: As recommended in writing by topcoat manufacturer.

2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
3) Topcoat: Latex stucco and masonry textured coating.

4. Concrete Substrates, Traffic Surfaces:
   a. Latex Floor Paint System: MPI EXT 3.2A.
      1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
      2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
      3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
   b. Alkyd Floor Enamel System: MPI EXT 3.2D.
      1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
      2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
      3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
   c. Clear Sealer System: MPI EXT 3.2G.
      1) Prime Coat: Interior/exterior clear concrete floor sealer (solvent based).
      2) Intermediate Coat: Interior/exterior clear concrete floor sealer (solvent based).
      3) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
   d. Water-Based Clear Sealer System: MPI EXT 3.2H.
      1) Prime Coat: Interior/exterior clear concrete floor sealer (water based).
      2) Intermediate Coat: Interior/exterior clear concrete floor sealer (water based).
      3) Topcoat: Interior/exterior clear concrete floor sealer (water based).
5. Clay-Masonry Substrates:
   a. Latex System: MPI EXT 4.1A.
      1) Prime Coat: Exterior latex matching topcoat.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. High-Build Latex System: MPI EXT 4.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).
      1) Prime Coat: As recommended in writing by topcoat manufacturer.
      2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
      3) Topcoat: High-build latex (exterior).
   c. Latex Aggregate System: MPI EXT 4.1B.
      1) Prime Coat: As recommended in writing by topcoat manufacturer.
      2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
      3) Topcoat: Latex stucco and masonry textured coating.
6. CMU Substrates:
   a. Latex System: MPI EXT 4.2A.
      1) Prime Coat: Interior/exterior latex block filler.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Latex Over Alkali-Resistant Primer System: MPI EXT 4.2L.
      1) Prime Coat: Alkali-resistant primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. High-Build Latex System: MPI EXT 4.2K, applied to form dry film thickness of not less than 10 mils (0.25 mm).
      1) Prime Coat: As recommended in writing by topcoat manufacturer.
      2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
      3) Topcoat: High-build latex (exterior).
   d. Latex Aggregate System: MPI EXT 4.2B.
      1) Prime Coat: As recommended in writing by topcoat manufacturer.
      2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
      3) Topcoat: Latex stucco and masonry textured coating.
7. Steel Substrates:
   a. Quick-Drying Enamel System: MPI EXT 5.1A.
      1) Prime Coat: Quick-drying alkyd metal primer.
      2) Intermediate Coat: Quick-drying enamel matching topcoat.
      3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.

b. Alkyd System: MPI EXT 5.1D.
   1) Prime Coat: Alkyd anticorrosive metal primer.
   2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
   3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
c. Aluminum Paint System: MPI EXT 5.1K.
   1) Prime Coat: Alkyd anticorrosive metal primer.
   2) Intermediate Coat: Aluminum paint.
   3) Topcoat: Aluminum paint.

8. Galvanized-Metal Substrates: Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primer is field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate surface preparation and primers.
   a. Latex System: MPI EXT 5.3A.
      1) Prime Coat: Cementitious galvanized-metal primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Latex Over Water-Based Primer System: MPI EXT 5.3H. "MPI Manual" recommends latex over water-based primer system for low-contact/traffic areas.
      1) Prime Coat: Waterborne galvanized-metal primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. Alkyd System: MPI EXT 5.3B.
      1) Prime Coat: Cementitious galvanized-metal primer.
      2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
      3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
9. Aluminum Substrates:
   a. Latex System: MPI EXT 5.4H.
      1) Prime Coat: Quick-drying primer for aluminum.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Alkyd System: MPI EXT 5.4F.
      1) Prime Coat: Quick-drying primer for aluminum.
      2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
      3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
10. Glue-Laminated Beam and Column Substrates:
   a. Latex System: MPI EXT 6.1L.
      1) Prime Coat: Exterior latex wood primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Latex Over Alkyd Primer System: MPI EXT 6.1A.
      1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. Alkyd System: MPI EXT 6.1B.
      1) Prime Coat: Exterior alkyd **OR** oil, **as directed,** wood primer.
      2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
      3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
11. Dressed Lumber Substrates: Including architectural woodwork **OR** doors, **as directed**.
   a. Latex System: MPI EXT 6.3L.
      1) Prime Coat: Exterior latex wood primer.
      2) Intermediate Coat: Exterior latex matching topcoat.
      3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.
   b. Latex Over Alkyd Primer System: MPI EXT 6.3A.
      1) Prime Coat: Exterior alkyd **OR** oil, **as directed,** wood primer.
      2) Intermediate Coat: Exterior latex matching topcoat.

3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.

c. Alkyd System: MPI EXT 6.3B.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed,** wood primer.
2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.

12. Wood Panel Substrates: Including plywood siding **OR** fascias **OR** soffits, **as directed**.
a. Latex System: MPI EXT 6.4K.
1) Prime Coat: Exterior latex wood primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
b. Latex Over Alkyd Primer System: MPI EXT 6.4G.
1) Prime Coat: Exterior alkyd wood primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
c. Alkyd System: MPI EXT 6.4B.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed,** wood primer.
2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

13. Wood Shingle and Shake Substrates (Excluding Roofs):
a. Latex System: MPI EXT 6.6E.
1) Prime Coat: Exterior latex wood primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
b. Latex Over Alkyd Primer System: MPI EXT 6.6A.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
c. Alkyd System: MPI EXT 6.6B.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

14. Dimension Lumber Substrates, Nontraffic Surfaces: Including board siding **OR** fencing **OR** undersides of decking, **as directed**.
a. Latex System: MPI EXT 6.2M.
1) Prime Coat: Exterior latex wood primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
b. Latex Over Alkyd Primer System: MPI EXT 6.2A.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed,** wood primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
c. Alkyd System: MPI EXT 6.2C.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed,** wood primer.
2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

15. Dimension Lumber Substrates, Traffic Surfaces: Including lumber decking **OR** stairs, **as directed**.
a. Latex System: MPI EXT 6.5E.
1) Prime Coat: Exterior latex wood primer.
2) Intermediate Coat: Interior/exterior latex floor and porch (low gloss).
3) Topcoat: Interior/exterior latex floor and porch (low gloss).
a) With additive to increase skid resistance of painted surface.
b. Latex Over Alkyd Primer System: MPI EXT 6.5A.
1) Prime Coat: Exterior alkyd wood primer.

2) Intermediate Coat: Interior/exterior latex floor and porch (low gloss).
3) Topcoat: Interior/exterior latex floor and porch (low gloss).
a) With additive to increase skid resistance of painted surface.

c. Alkyd Floor Enamel System: MPI EXT 6.5B.
1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
a) With additive to increase skid resistance of painted surface.

16. Plastic Trim Fabrication Substrates:
a. Latex System: MPI EXT 6.8A.
1) Prime Coat: Bonding primer (water based) **OR** (solvent based), **as directed**.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
b. Alkyd System: MPI EXT 6.8B.
1) Prime Coat: Bonding primer (water based) **OR** (solvent based , **as directed**.
2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

17. Stucco Substrates:
a. Latex System: MPI EXT 9.1A.
1) Prime Coat: Exterior latex matching topcoat.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
b. Latex Over Alkali-Resistant Primer System: MPI EXT 9.1J.
1) Prime Coat: Alkali-resistant primer.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
c. High-Build Latex System: MPI EXT 9.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).
1) Prime Coat: As recommended in writing by topcoat manufacturer.
2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
3) Topcoat: High-build latex (exterior).

18. Exterior Gypsum Board Substrates:
a. Latex System: MPI EXT 9.2A.
1) Prime Coat: Exterior latex matching topcoat.
2) Intermediate Coat: Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

END OF SECTION 09 91 13 00

SECTION 09 91 13 00a - WOOD STAINS AND TRANSPARENT FINISHES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for wood stains and transparent finishes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes surface preparation and the application of wood finishes on the following substrates:
   a. Exterior Substrates:
      1) Exposed glue-laminated beams and columns.
      2) Exposed dimension lumber (rough carpentry).
      3) Dressed lumber (finish carpentry).
      4) Exposed wood panel products.
      5) Wood decks and stairs.
      6) Wood shingles and shakes (excluding roofs).
   b. Interior Substrates:
      1) Exposed glue-laminated beams and columns.
      2) Exposed dimension lumber (rough carpentry).
      3) Dressed lumber (finish carpentry).
      4) Exposed wood panel products.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
   a. Product Data for Credit EQ 4.2: For interior primers, stains, and transparent finishes, including printed statement of VOC content.
3. Samples: For each finish and for each color and texture required.
4. Product List: Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 1.2, with the product proposed for use highlighted.

D. Quality Assurance
1. MPI Standards:
   a. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."
   b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and finish systems indicated.

E. Delivery, Storage, And Handling
1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   a. Maintain containers in clean condition, free of foreign materials and residue.
   b. Remove rags and waste from storage areas daily.

F. Project Conditions
1. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply exterior finishes in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Materials, General
1. Material Compatibility:
a. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
b. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
2. VOC Content of Field-Applied Interior Primers, Stains, and Transparent Finishes: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to primers, stains, and transparent finishes that are applied in a fabrication or finishing shop:
a. Flat Primers: VOC content of not more than 50 g/L.
b. Nonflat Primers: VOC content of not more than 150 g/L.
c. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
d. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
e. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
f. Floor Coatings: VOC not more than 100 g/L.
g. Shellacs, Clear: VOC not more than 730 g/L.
h. Stains: VOC not more than 250 g/L.
3. Stain Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.

B. Wood Fillers
1. Wood Filler Paste: MPI #91.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

C. Primers And Sealers
1. Exterior Alkyd Wood Primer: MPI #5.
a. VOC Content: E Range of E2 **OR** E3, **as directed**.
2. Exterior Latex Wood Primer: MPI #6.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior Oil Wood Primer: MPI #7.
a. VOC Content: E Range of E2.
4. Wood Preservative: MPI #37.
a. VOC Content: E Range of E1 **OR** E3, **as directed**.
5. Alkyd Sanding Sealer: MPI #102.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Lacquer Sanding Sealer: MPI #84.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
7. Shellac: MPI #88.
a. VOC Content: E Range of E2 **OR** E3, **as directed**.

D. Stains
1. Exterior Semitransparent Stain (Solvent Based): MPI #13.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Exterior Solid-Color Stain (Solvent Based): MPI #14.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior, Solid-Color Latex Stain: MPI #16.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Stain for Wood Decks: MPI #33.
a. VOC Content: E Range of E1 **OR** E3, **as directed**.
5. Interior Wood Stain (Semitransparent): MPI #90.

a. VOC Content: E Range of E1 **OR** E2, **as directed**.

E. Varnishes
1. Exterior Marine Spar Varnish (Gloss): MPI #28, Gloss Level 7.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Exterior Varnish (Gloss): MPI #29, Gloss Level 6.
a. VOC Content: E Range of E1.
3. Exterior Varnish (Semigloss): MPI #30, Gloss Level 5.
a. VOC Content: E Range of E1.
4. Interior Varnish (Flat): MPI #73, Gloss Level 1, alkyd type.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
5. Interior Varnish (Semigloss): MPI #74, Gloss Level 5, alkyd type.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Interior Varnish (Gloss): MPI #75, Gloss Level 6, alkyd type.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

F. Polyurethane Finishes
1. Two-Component Aliphatic Polyurethane (Clear): MPI #78.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Interior, Oil-Modified, Clear Urethane (Gloss): MPI #56, Gloss Level 6.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Moisture-Cured Clear Polyurethane (Flat): MPI #71, Gloss Level 1.
a. VOC Content: E Range of E2.
5. Moisture-Cured Clear Polyurethane (Gloss): MPI #31.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Waterborne Acrylic Finishes
1. Waterborne Clear Acrylic (Satin): MPI #128, Gloss Level 4.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
2. Waterborne Clear Acrylic (Semigloss): MPI #129, Gloss Level 5.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Waterborne Clear Acrylic (Gloss): MPI #130, Gloss Level 6.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3**, as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.

H. Lacquers
1. Lacquer (Clear Flat): MPI #87, Gloss Level 1.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Lacquer (Clear Satin): MPI #85, Gloss Level 4.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Lacquer (Clear Gloss): MPI #86, Gloss Level 6.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

I. Oil Finish
1. Danish Oil: MPI #92.
a. VOC Content: E Range of E3.

1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
   a. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.
3. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
   a. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
   b. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
   c. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.
4. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

B. Application
1. Apply finishes according to manufacturer's written instructions.
   a. Use applicators and techniques suited for finish and substrate indicated.
   b. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
2. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

C. Field Quality Control
1. The following procedure may be requested at any time and as often as the Owner deems necessary during the period when finishes are being applied:
   a. Engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will perform tests for compliance with product requirements.
   c. the Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes are incompatible.

D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

E. Exterior Wood-Finish-System Schedule
1. Exposed Glue-Laminated Beam and Column Substrates:
   a. Solid-Color, Solvent-Based Stain System: MPI EXT 6.1C.

1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
2) Two Stain Coats: Exterior solid-color stain (solvent based).

b. Varnish Over Semitransparent Stain System: MPI EXT 6.1D.
1) Stain Coat: Exterior semitransparent stain (solvent based).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.

c. Varnish System: MPI EXT 6.1K.
1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.

d. Clear, Two-Component Polyurethane Over Stain System: MPI EXT 6.1E.
1) Stain Coat: Exterior semitransparent stain (solvent based).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Two-component aliphatic polyurethane (clear).

e. Clear, Two-Component Polyurethane System: MPI EXT 6.1H.
1) Three Finish Coats: Two-component aliphatic polyurethane (clear).

2. Exposed Rough Carpentry Substrates:
a. Solid-Color Latex Stain System: MPI EXT 6.2B.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.

b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.2D.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.

c. Two Stain Coats (for a Premium Grade system) One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).

d. Semitransparent Stain System: MPI EXT 6.2L.
1) Two Stain Coats: Exterior semitransparent stain (solvent based).

e. Varnish Over Semitransparent Stain System: MPI EXT 6.2E.
1) Stain Coat: Exterior semitransparent stain (solvent based).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.

f. Varnish System: MPI EXT 6.2K.
1) Four (for a Premium Grade system) **OR** Three, **as directed,** Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.

g. Clear, Two-Component Polyurethane System: MPI EXT 6.2H.
1) Three Finish Coats: Two-component aliphatic polyurethane (clear).

3. Finish Carpentry Substrates:
a. Solid-Color Latex Stain System: MPI EXT 6.3K.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.

b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.3C.
1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).

c. Semitransparent Stain System: MPI EXT 6.3D.
1) Two Stain Coats: Exterior semitransparent stain (solvent based).

d. Varnish Over Semitransparent Stain System: MPI EXT 6.3E.
1) Stain Coat: Exterior semitransparent stain (solvent based).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.

e. Varnish System: MPI EXT 6.3F.
1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.

f. Clear, Two-Component Polyurethane System: MPI EXT 6.3G.
1) Three Finish Coats: Two-component aliphatic polyurethane (clear).

F. Exposed Wood Panel-Product Substrates:
   a. Solid-Color Latex Stain System: MPI EXT 6.4A.
      1) Prime Coat: Exterior alkyd **OR** latex **OR** oil, **as directed**, wood primer.
      2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
   b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.4C.
      1) Prime Coat (for a Premium Grade system): Exterior alkyd **OR** oil, **as directed**, wood primer.
      2) Two Stain Coats: Exterior solid-color stain (solvent based).
   c. Semitransparent Stain System: MPI EXT 6.4D.
      1) Two Stain Coats: Exterior semitransparent stain (solvent based).
   d. Varnish Over Semitransparent Stain System: MPI EXT 6.4J.
      1) Stain Coat: Exterior semitransparent stain (solvent based).
      2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
   e. Varnish System: MPI EXT 6.4H.
      1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
2. Wood Deck and Stair Substrates:
   a. MPI EXT 6.5D.
      1) Preservative Coat: Wood preservative.
      2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Stain for wood decks.
   b. MPI EXT 6.5F.
      1) Two Stain Coats: Stain for wood decks.
3. Wood Shingle and Shake Substrates (Excluding Roofs):
   a. Solid-Color Latex Stain System: MPI EXT 6.6D.
      1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
      2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
   b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.6C.
      1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
      2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
   c. Semitransparent Stain System: MPI EXT 6.6F.
      1) Two Stain Coats: Exterior semitransparent stain (solvent based).

G. Interior Wood-Finish-System Schedule
1. Exposed Glue-Laminated Beam and Column Substrates:
   a. Alkyd Varnish Over Stain System: MPI INT 6.1K.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.1P.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Seal Coat: Alkyd sanding sealer.
      3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. Alkyd Varnish Over Sealer System: MPI INT 6.1C.
      1) Seal Coat: Alkyd sanding sealer.
      2) Two Finish Coats: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   d. Polyurethane Varnish Over Stain System: MPI INT 6.1J.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.

e. Polyurethane Varnish System: MPI INT 6.1D.
   1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
   2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
f. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.1S.
   1) Stain Coat: Interior wood stain (semitransparent).
   2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
g. Waterborne Clear Acrylic Over Stain System: MPI INT 6.1R.
   1) Stain Coat: Interior wood stain (semitransparent).
   2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
h. Waterborne Clear Acrylic System: MPI INT 6.F.
   1) Three Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
i. Solid-Color Latex Stain System: MPI INT 6.1T.
   1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
   2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
j. Solid-Color, Solvent-Based Stain System: MPI INT 6.1H.
   1) Two Stain Coats: Exterior solid-color stain (solvent based).
k. Semitransparent Stain System: MPI INT 6.1G.
   1) Two Stain Coats: Exterior semitransparent stain (solvent based).

2. Exposed Rough Carpentry Substrates:
   a. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.2K.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Seal Coat: Alkyd sanding sealer.
      3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Alkyd Varnish Over Sealer System: MPI INT 6.2P.
      1) Seal Coat: Alkyd sanding sealer.
      2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. Polyurethane Varnish Over Stain System: MPI INT 6.2J.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
   d. Polyurethane Varnish System: MPI INT 6.2H.
      1) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
   e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.2N.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
   f. Waterborne Clear Acrylic Over Stain System: MPI INT 6.2M.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

3. Finish Carpentry Substrates:
   a. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.3D.
      1) Stain Coat: Interior wood stain (semitransparent).
      2) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
      3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (semigloss) **OR** (gloss), **as directed**.
   b. Alkyd Varnish Over Sealer System: MPI INT 6.3J.
      1) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.

2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (semigloss) **OR** (gloss), **as directed**.

c. Polyurethane Varnish Over Stain System: MPI INT 6.3E.
1) Stain Coat: Interior wood stain (semitransparent).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.

d. Polyurethane Varnish System: MPI INT 6.3K.
1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.

e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.3Y.
1) Stain Coat: Interior wood stain (semitransparent).
2) Three (for a Premium Grade system **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.

f. Moisture-Cured Clear Polyurethane System: MPI INT 6.3X.
1) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.

g. Clear, Two-Component Polyurethane System: MPI INT 6.3Z.
1) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Two-component aliphatic polyurethane (clear).

h. Waterborne Clear Acrylic Over Stain System: MPI INT 6.3W.
1) Stain Coat: Interior wood stain (semitransparent).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

i. Waterborne Clear Acrylic System: MPI INT 6.3Q.
1) Three Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

j. Lacquer Over Stain and Sealer System: MPI INT 6.3F.
1) Stain Coat: Interior wood stain (semitransparent).
2) Seal Coat: Lacquer sanding sealer.
3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).

k. Lacquer Over Sealer System: MPI INT 6.3H.
1) Seal Coat: Lacquer sanding sealer.
2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).

l. Semitransparent Stain System: MPI INT 6.3C.
1) Two Stain Coats: Exterior semitransparent stain (solvent based).

m. Danish Oil System: MPI INT 6.3M.
1) Two Finish Coats: Danish oil.

4. Exposed Wood Panel-Product Substrates:

a. Alkyd Varnish Over Sealer and Stain System: MPI INT 6.4D.
1) Stain Coat: Interior wood stain (semitransparent).
2) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Alkyd Varnish Over Sealer System: MPI INT 6.4G.
1) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Polyurethane Varnish Over Stain System: MPI INT 6.4E.
1) Stain Coat: Interior wood stain (semitransparent).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.

d. Polyurethane Varnish System: MPI INT 6.4.J.

1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.

e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.4V.
1) Stain Coat: Interior wood stain (semitransparent).
2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.

f. Waterborne Clear Acrylic Over Stain System: MPI INT 6.4U.
1) Stain Coat: Interior wood stain (semitransparent).
2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

g. Lacquer Over Stain and Sealer System: MPI INT 6.4F.
1) Stain Coat: Interior wood stain (semitransparent).
2) Seal Coat: Lacquer sanding sealer.
3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).

h. Lacquer Over Sealer System: MPI INT 6.4Y.
1) Seal Coat: Lacquer sanding sealer.
2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).

i. Semitransparent Stain System: MPI INT 6.4C.
1) Two Stain Coats: Exterior semitransparent stain (solvent based).

j. Danish Oil System: MPI INT 6.4K.
1) Two Finish Coats: Danish oil.

END OF SECTION 09 91 13 00a

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SECTION 09 91 13 00b - HIGH-TEMPERATURE-RESISTANT COATINGS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for high-temperature-resistant coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes surface preparation and application of high-temperature-resistant coating systems on steel substrates subject to high temperatures.

C. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For each coating and for each color and texture required.
3. LEED Submittal:
   a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance
1. Master Painters Institute (MPI) Standards:
   a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List" **OR** "MPI Maintenance Repainting Manual," **as directed**.
   b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.

E. Delivery, Storage, And Handling
1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   a. Maintain containers in clean condition, free of foreign materials and residue.
   b. Remove rags and waste from storage areas daily.

F. Project Conditions
1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 104 deg F (10 and 40 deg C).
2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. High-Temperature-Resistant Coatings
1. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) :
   a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
   b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
   c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
   d. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
   e. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.

f. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
g. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
h. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.

2. Chemical Components of Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
   b. Restricted Components: Paints and coatings shall not contain any of the following:
      1) Acrolein.
      2) Acrylonitrile.
      3) Antimony.
      4) Benzene.
      5) Butyl benzyl phthalate.
      6) Cadmium.
      7) Di (2-ethylhexyl) phthalate.
      8) Di-n-butyl phthalate.
      9) Di-n-octyl phthalate.
      10) 1,2-dichlorobenzene.
      11) Diethyl phthalate.
      12) Dimethyl phthalate.
      13) Ethylbenzene.
      14) Formaldehyde.
      15) Hexavalent chromium.
      16) Isophorone.
      17) Lead.
      18) Mercury.
      19) Methyl ethyl ketone.
      20) Methyl isobutyl ketone.
      21) Methylene chloride.
      22) Naphthalene.
      23) Toluene (methylbenzene).
      24) 1,1,1-trichloroethane.
      25) Vinyl chloride.
3. Colors: As selected from manufacturer's full range **OR** Match samples, **as directed**.
4. Primer: Undercoating recommended in writing for use in coating system by manufacturer of high-temperature-resistant coating under conditions indicated.
5. Heat-Resistant Enamel (Gloss): MPI #21.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Inorganic Zinc Primer: MPI #19.
   a. VOC Content: Minimum E Range of 0 **OR** E1 **OR** E2 **OR** E3, **as directed**.
7. Aluminum Heat-Resistant Enamel: MPI #2.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
8. High-Heat-Resistant Coating: MPI #22.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.

1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed,** applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean steel substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
   a. Remove incompatible primers as required to produce coating systems indicated.

B. Application
1. Apply high-temperature-resistant coating systems according to manufacturer's written instructions.
   a. Use applicators and techniques suited for coating and substrate indicated.
   b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

C. Field Quality Control
1. Contractor shall invoke the following procedure at any time and as often as necessary during the period when coatings are being applied:
   a. Engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will perform tests for compliance with specified requirements.
   c. the Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

E. High-Temperature-Resistant Coating Schedule
1. Heat-Resistant Enamel (Gloss) Coating System (System below corresponds with MPI EXT 5.2A and MPI INT 5.2A coating systems) {suitable for use on surfaces that reach a maximum temperature of 400 deg F (205 deg C)}:
   a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
   b. Prime Coat: Primer.

c. Finish Coat(s): Heat-resistant enamel (gloss), MPI #21, in number of coats recommended in writing by manufacturer for conditions indicated.

2. Inorganic Zinc Primer Coating System (System below corresponds with MPI EXT 5.2C and MPI INT 5.2C coating systems) {suitable for use on surfaces that reach a maximum temperature of 750 deg F (400 deg C)}:
   a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
   b. Prime Coat: Primer.
   c. Finish Coat(s): Inorganic zinc primer, MPI #19, in number of coats recommended in writing by manufacturer for conditions indicated.
3. Aluminum Heat-Resistant Enamel Coating System (System below corresponds with MPI EXT 5.2B and MPI INT 5.2B coating systems) {suitable for use on surfaces that reach a maximum temperature of 800 deg F (427 deg C)}:
   a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
   b. Prime Coat: Primer.
   c. Finish Coat(s): Aluminum heat-resistant enamel, MPI #2, in number of coats recommended in writing by manufacturer for conditions indicated.
4. High-Heat-Resistant Coating System (System below corresponds with MPI EXT 5.2D and MPI INT 5.2D coating systems) {suitable for use on surfaces that reach a maximum temperature of 1100 deg F (593 deg C)}:
   a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
   b. Prime Coat: Primer.
   c. Finish Coat(s): High-heat-resistant coating, MPI #22, in number of coats recommended in writing by manufacturer for conditions indicated.

END OF SECTION 09 91 13 00b

Task	Specification	Specification Description
09 91 13 00	01 22 16 00	No Specification Required

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SECTION 09 91 23 00 - INTERIOR PAINTING

1.1 GENERAL

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

B. Summary
1. This Section includes surface preparation and the application of paint systems on the following interior substrates:
   a. Concrete.
   b. Clay masonry.
   c. Concrete masonry units (CMU).
   d. Steel.
   e. Galvanized metal.
   f. Aluminum (not anodized or otherwise coated).
   g. Wood.
   h. Gypsum board.
   i. Plaster.
   j. Spray-textured ceilings.
   k. Cotton or canvas insulation covering.

C. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For each finish and for each color and texture required.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.
4. LEED Submittal:
   a. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.

D. Quality Assurance
1. MPI Standards:
   a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
2. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   a. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      2) Other Items: Architect will designate items or areas required.
   b. Final approval of color selections will be based on mockups.
      1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling
1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
a. Maintain containers in clean condition, free of foreign materials and residue.
b. Remove rags and waste from storage areas daily.

F. Project Conditions
1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Paint, General
1. Material Compatibility:
a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
d. Floor Coatings: VOC not more than 100 g/L.
e. Shellacs, Clear: VOC not more than 730 g/L.
f. Shellacs, Pigmented: VOC not more than 550 g/L.
g. Flat Topcoat Paints: VOC content of not more than 50 g/L.
h. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
i. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
j. Floor Coatings: VOC not more than 100 g/L.
k. Shellacs, Clear: VOC not more than 730 g/L.
l. Shellacs, Pigmented: VOC not more than 550 g/L.
m. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
n. Dry-Fog Coatings: VOC content of not more than 400 g/L.
o. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
p. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
b. Restricted Components: Paints and coatings shall not contain any of the following:

1) Acrolein.
2) Acrylonitrile.
3) Antimony.
4) Benzene.
5) Butyl benzyl phthalate.
6) Cadmium.
7) Di (2-ethylhexyl) phthalate.
8) Di-n-butyl phthalate.
9) Di-n-octyl phthalate.
10) 1,2-dichlorobenzene.
11) Diethyl phthalate.
12) Dimethyl phthalate.
13) Ethylbenzene.
14) Formaldehyde.
15) Hexavalent chromium.
16) Isophorone.
17) Lead.
18) Mercury.
19) Methyl ethyl ketone.
20) Methyl isobutyl ketone.
21) Methylene chloride.
22) Naphthalene.
23) Toluene (methylbenzene).
24) 1,1,1-trichloroethane.
25) Vinyl chloride.

4. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.

B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI #4.
a. VOC Content: E Range of E2 **OR** E3, **as directed**.

C. Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
2. Interior Alkyd Primer/Sealer: MPI #45.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

D. Metal Primers
1. Alkyd Anticorrosive Metal Primer: MPI #79.
a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Quick-Drying Alkyd Metal Primer: MPI #76.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Rust-Inhibitive Primer (Water Based): MPI #107.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
4. Cementitious Galvanized-Metal Primer: MPI #26.
a. VOC Content: E Range of E1.
5. Waterborne Galvanized-Metal Primer: MPI #134.
a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
6. Vinyl Wash Primer: MPI #80.
a. VOC Content: E Range of E2 **OR** E3, **as directed**.

7. Quick-Drying Primer for Aluminum: MPI #95.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

E. Wood Primers
1. Interior Latex-Based Wood Primer: MPI #39.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.

F. Latex Paints
1. Interior Latex (Flat): MPI #53 (Gloss Level 1).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 0.5 **OR** EPR 1.5 **OR** EPR 2.5, **as directed**.
2. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
4. Interior Latex (Satin): MPI #43 (Gloss Level 4).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 1.5 **OR** EPR 2 **OR** EPR 2.5 **OR** EPR 3.5, **as directed**.
5. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
6. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
7. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).
   a. VOC Content: E Range of E3.
   b. Environmental Performance Rating: EPR 4 **OR** EPR 5.5, **as directed**.
8. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).
   a. VOC Content: E Range of E3.
   b. Environmental Performance Rating: EPR 4.5.
9. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
   a. VOC Content: E Range of E3.
   b. Environmental Performance Rating: EPR 4.5.
10. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
   a. VOC Content: E Range of E3.
   b. Environmental Performance Rating: EPR 3 **OR** EPR 5.5, **as directed**.
11. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 4 **OR** EPR 5 **OR** EPR 6, **as directed**.
12. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).
   a. VOC Content: E Range of E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 5 **OR** EPR 6, **as directed**.
13. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
   a. VOC Content: E Range of E1 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 4.5 **OR** EPR 6.5, **as directed**.
14. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 5 **OR** EPR 6 **OR** EPR 7, **as directed**.
15. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
16. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

17. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
    a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Alkyd Paints
1. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).
   a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
   a. VOC Content: E Range of E1 **OR** E2, **as directed**.
   b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
4. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
   a. VOC Content: E Range of E1 **OR** E2, **as directed**.

H. Quick-Drying Enamels
1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

I. Textured Coating
1. Latex Stucco and Masonry Textured Coating: MPI #42.
   a. VOC Content: E Range of E2 **OR** E3, **as directed**.

J. Dry Fog/Fall Coatings
1. Latex Dry Fog/Fall: MPI #118.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
2. Waterborne Dry Fall: MPI #133.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Interior Alkyd Dry Fog/Fall: MPI #55.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

K. Aluminum Paint
1. Aluminum Paint: MPI #1.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

L. Floor Coatings
1. Interior Concrete Floor Stain: MPI #58.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 2.
2. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
   a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
   a. VOC Content: E Range of E1 **OR** E2, **as directed**.
4. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
   a. VOC Content: E Range of E2 **OR** E3, **as directed**.
   b. Environmental Performance Rating: EPR 3.
5. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
   a. VOC Content: E Range of E1 **OR** E2, **as directed**.
   b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.

1.3 EXECUTION

A. Preparation
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
3. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
7. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
8. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
9. Aluminum Substrates: Remove surface oxidation.
10. Wood Substrates:
    a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
    b. Sand surfaces that will be exposed to view, and dust off.
    c. Prime edges, ends, faces, undersides, and backsides of wood.
    d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
11. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
12. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
13. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.
14. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

B. Application
1. Apply paints according to manufacturer's written instructions.
   a. Use applicators and techniques suited for paint and substrate indicated.
   b. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   c. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
5. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
   a. Mechanical Work:
      1) Uninsulated metal piping.
      2) Uninsulated plastic piping.
      3) Pipe hangers and supports.
      4) Tanks that do not have factory-applied final finishes.
      5) Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
      6) Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      7) Mechanical equipment that is indicated to have a factory-primed finish for field painting.
   b. Electrical Work:
      1) Switchgear.
      2) Panelboards.
      3) Electrical equipment that is indicated to have a factory-primed finish for field painting.

C. Field Quality Control
1. Testing of Paint Materials: The following procedure may be requested at any time and as often as the Owner deems necessary during the period when paints are being applied:
   a. Engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will perform tests for compliance with product requirements.
   c. the Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

E. Interior Painting Schedule
1. Concrete Substrates, Nontraffic Surfaces:
   a. Latex System: MPI INT 3.1E.
      1) Prime Coat: Interior latex matching topcoat.
      2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
      3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Latex Over Sealer System: MPI INT 3.1A.

1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Latex Over Latex Aggregate System: MPI INT 3.1B.
1) Prime Coat: Latex stucco and masonry textured coating.
2) Intermediate Coat (for MPI Premium Grade system): Exterior latex matching topcoat.
3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Alkyd System: MPI INT 3.1D.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

e. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.
1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

f. High-Performance Architectural Latex System: MPI INT 3.1C.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

2. Concrete Substrates, Traffic Surfaces:
a. Latex Floor Enamel System: MPI INT 3.2A.
1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
2) Intermediate Coat (for MPI Premium Grade system): Interior/exterior latex floor and porch paint (low gloss).
3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).

b. Alkyd Floor Enamel System: MPI INT 3.2B.
1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
2) Intermediate Coat (for MPI Premium Grade system): Exterior/interior alkyd floor enamel (gloss).
3) Topcoat: Exterior/interior alkyd floor enamel (gloss).

c. Concrete Stain System: MPI INT 3.2E.
1) First Coat (for MPI Premium Grade system): Interior concrete floor stain.
2) Topcoat: Interior concrete floor stain.

d. Clear Sealer System: MPI INT 3.2F.
1) First Coat: Interior/exterior clear concrete floor sealer (solvent based).
2) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).

e. Water-Based Clear Sealer System: MPI INT 3.2G.
1) First Coat: Interior/exterior clear concrete floor sealer (water based).
2) Topcoat: Interior/exterior clear concrete floor sealer (water based).

3. Clay-Masonry Substrates:
a. Latex System: MPI INT 4.1A.
1) Prime Coat: Interior latex matching topcoat.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Alkyd System: MPI INT 4.1D.
1) Prime Coat: Interior latex primer/sealer.

2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Latex Aggregate System: MPI INT 4.1B.
1) Prime Coat: As recommended in writing by topcoat manufacturer.
2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
3) Topcoat: Latex stucco and masonry textured coating.

d. Institutional Low-Odor/VOC Latex System: MPI INT 4.1M.
1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 4.1L.
1) Prime Coat: High-performance architectural latex matching topcoat.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

4. CMU Substrates:

a. Latex System: MPI INT 4.2A.
1) Prime Coat: Interior/exterior latex block filler.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Alkyd System: MPI INT 4.2C.
1) Prime Coat: Interior/exterior latex block filler.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Alkyd Over Latex Sealer System: MPI INT 4.2N.
1) Prime Coat: Interior/exterior latex block filler.
2) Sealer Coat: Interior latex primer/sealer.
3) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
4) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
1) Prime Coat: Interior/exterior latex block filler.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 4.2D.
1) Prime Coat: Interior/exterior latex block filler.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

5. Steel Substrates:

a. Quick-Drying Enamel System: MPI INT 5.1A.
1) Prime Coat: Quick-drying alkyd metal primer.
2) Intermediate Coat: Quick-drying enamel matching topcoat.
3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.

b. Water-Based Dry-Fall System: MPI INT 5.1C.
1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
2) Topcoat: Latex dry fog/fall **OR** Waterborne dry fall, **as directed**.

c. Alkyd Dry-Fall System: MPI INT 5.1D.
   1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
   2) Topcoat: Interior alkyd dry fog/fall.
d. Latex Over Alkyd Primer System: MPI INT 5.1Q.
   1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
   2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
   3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
e. Alkyd System: MPI INT 5.1E.
   1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
   2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
   3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
f. Aluminum Paint System: MPI INT 5.1M.
   1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
   2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
   3) Topcoat: Aluminum paint.
g. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.
   1) Prime Coat: Rust-inhibitive primer (water based).
   2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
   3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
h. High-Performance Architectural Latex System: MPI INT 5.1R.
   1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
   2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
   3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

6. Galvanized-Metal Substrates:
   a. Water-Based Dry-Fall System: MPI INT 5.3H.
      1) Prime Coat: Waterborne dry fall.
      2) Topcoat: Waterborne dry fall.
   b. Alkyd Dry-Fall System: MPI INT 5.3F.
      1) Prime Coat: Cementitious galvanized-metal primer.
      2) Topcoat: Interior alkyd dry fog/fall.
   c. Latex System: MPI INT 5.3A.
      1) Prime Coat: Cementitious galvanized-metal primer.
      2) Intermediate Coat: Interior latex matching topcoat.
      3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
   d. Latex Over Waterborne Primer System: MPI INT 5.3J.
      1) Prime Coat: Waterborne galvanized-metal primer.
      2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
      3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
   e. Alkyd System: MPI INT 5.3C.
      1) Prime Coat: Cementitious galvanized-metal primer.
      2) Intermediate Coat: Interior alkyd matching topcoat.
      3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
   f. Aluminum Paint System: MPI INT 5.3G.
      1) Prime Coat: Cementitious galvanized-metal primer.
      2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
      3) Topcoat: Aluminum paint.
   g. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.

1) Prime Coat: Waterborne galvanized-metal primer.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

h. High-Performance Architectural Latex System: MPI INT 5.3M.
1) Prime Coat: Waterborne galvanized-metal primer.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

7. Aluminum (Not Anodized or Otherwise Coated) Substrates:
a. Latex System: MPI INT 5.4H.
1) Prime Coat: Quick-drying primer for aluminum.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Alkyd Over Vinyl Wash Primer System: MPI INT 5.4A.
1) Prime Coat: Vinyl wash primer.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Alkyd Over Quick-Drying Primer System: MPI INT 5.4J.
1) Prime Coat: Quick-drying primer for aluminum.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Aluminum Paint System: MPI INT 5.4D.
1) Prime Coat: Vinyl wash primer.
2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
3) Topcoat: Aluminum paint.

e. Institutional Low-Odor/VOC Latex System: MPI INT 5.4G.
1) Prime Coat: Quick-drying primer for aluminum.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

f. High-Performance Architectural Latex System: MPI INT 5.4F.
1) Prime Coat: Quick-drying primer for aluminum.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

8. Glue-Laminated Beam and Column Substrates:
a. Latex System: MPI INT 6.1M.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Latex Over Alkyd Primer System: MPI INT 6.1A.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Alkyd System: MPI INT 6.1B.
1) Prime Coat: Interior alkyd primer/sealer.

2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Institutional Low-Odor/VOC Latex System: MPI INT 6.1Q.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 6.1N.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

9. Dressed Lumber Substrates: Including architectural woodwork and doors.
a. Latex System: MPI INT 6.3T.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.

b. Latex Over Alkyd Primer System: MPI INT 6.3U.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.

c. Alkyd System: MPI INT 6.3B.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Institutional Low-Odor/VOC Latex System: MPI INT 6.3V.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 6.3A.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

10. Wood Panel Substrates: Including painted plywood, medium-density fiberboard, and hardboard.
a. Latex System: MPI INT 6.4R.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.

b. Latex Over Alkyd Primer System: MPI INT 6.4A.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Alkyd System: MPI INT 6.4B.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.

1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat : Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 6.4S.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

11. Dimension Lumber Substrates, Nontraffic Surfaces: Including exposed joists and exposed beams.
a. Latex System: MPI INT 6.2D.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Latex Over Alkyd Primer System: MPI INT 6.2A.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat : Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Alkyd System: MPI INT 6.2C.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Institutional Low-Odor/VOC Latex System: MPI INT 6.2L.
1) Prime Coat: Interior latex-based wood primer.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 6.2B.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

12. Wood Substrates, Traffic Surfaces:
a. Latex Floor Paint System: MPI INT 6.5G.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).

b. Alkyd Floor Enamel System: MPI INT 6.5A.
1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
3) Topcoat: Exterior/interior alkyd floor enamel (gloss).

13. Gypsum Board Substrates:
a. Latex System: MPI INT 9.2A.
1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Alkyd Over Latex Primer System: MPI INT 9.2C.
1) Prime Coat: Interior latex primer/sealer.

2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

d. High-Performance Architectural Latex System: MPI INT 9.2B.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

14. Plaster Substrates:
a. Latex System: MPI INT 9.2A.
1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

b. Latex Over Alkyd Primer System: MPI INT 9.2K.
1) Prime Coat: Interior alkyd primer/sealer.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

c. Alkyd Over Latex Primer System: MPI INT 9.2C.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

e. High-Performance Architectural Latex System: MPI INT 9.2B.
1) Prime Coat: Interior latex primer/sealer.
2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

15. Spray-Textured Ceiling Substrates:
a. Latex (Flat) System: MPI INT 9.1A, spray applied.
1) Prime Coat: Interior latex primer/sealer **OR** (flat), **as directed**.
2) Topcoat: Interior latex (flat).

b. Latex System: MPI INT 9.1E, spray applied.
1) Prime Coat: Interior latex matching topcoat.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.

c. Latex Over Alkyd Primer System: MPI INT 9.1B.
1) Prime Coat: Interior alkyd primer/sealer.

2) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.

d. Alkyd (Flat) System: MPI INT 9.1C.
   1) Prime Coat: Interior alkyd (flat).
   2) Topcoat: Interior alkyd (flat).

e. Alkyd System: MPI INT 9.1D.
   1) Prime Coat: Interior alkyd primer/sealer.
   2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
   3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.

16. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.
   a. Latex System: MPI INT 10.1A.
      1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
      2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
      3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
   b. Alkyd Over Latex Primer System: MPI INT 10.1B.
      1) Prime Coat: Interior latex primer/sealer.
      2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
      3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
   c. Aluminum Paint System: MPI INT 10.1C.
      1) Prime Coat: Interior latex primer/sealer.
      2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
      3) Topcoat: Aluminum paint.
   d. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.
      1) Prime Coat: Interior latex primer/sealer.
      2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
      3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

END OF SECTION 09 91 23 00

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SECTION 09 91 23 00a - MULTICOLORED INTERIOR COATINGS

1.1 GENERAL

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

B. Summary
1. This Section includes surface preparation and field application of multicolor interior coating systems applied on the following substrates:
   a. Vertical concrete.
   b. Cementitious composition board.
   c. Clay masonry units.
   d. Concrete masonry units (CMU).
   e. Wood.
   f. Fiberglass moldings and trim.
   g. Plastic moldings and trim.
   h. Plaster, Gypsum veneer plaster, and Gypsum board.

C. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For each finish-coat product and for each color and texture required.
3. LEED Submittal:
   a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance
1. Fire-Test-Response Characteristics: Provide coatings with flame-spread and smoked-developed indexes of 25 or less and 450 or less, respectively, as determined by testing identical products per ASTM E 84 by testing and inspecting agency acceptable to authorities having jurisdiction.
2. Master Painters Institute (MPI) Standards: Comply with recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, applicable to products and coating systems indicated.
3. Mockups: Apply mockup of each coating system indicated to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   a. Architect will select one surface to represent surfaces and conditions for application of each coating system and type of substrate.
      1) Wall Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      2) Other Items: Architect will designate items or areas required.
   b. Apply mockup after permanent lighting and other environmental services have been activated.
   c. Final approval of color and pattern selections will be based on mockup.
      1) If preliminary color and pattern selections are not approved, apply additional mockups of colors and patterns selected by Architect at no added cost to Owner.
   d. Repair Mockup: After approval of color and pattern selections, apply representative repairs to 100 sq. in. (65 sq. cm) of mockup to establish quality standards for coating system repairs.
   e. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

f. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling
1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
a. Maintain containers in clean condition, free of foreign materials and residue.
b. Remove rags and waste from storage areas daily.

1.2 PRODUCTS

A. Multicolor Coating Systems, General
1. Material Compatibility: Provide materials for use within each coating system that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
c. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
d. Shellacs, Clear: VOC not more than 730 g/L.
e. Shellacs, Pigmented: VOC not more than 550 g/L.
f. Flat Topcoat Paints: VOC content of not more than 50 g/L.
g. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
h. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
i. Shellacs, Clear: VOC not more than 730 g/L.
j. Shellacs, Pigmented: VOC not more than 550 g/L.
k. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
3. Chemical Components of Interior Paints and Coatings: Provide topcoat paints that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
b. Restricted Components: Paints and coatings shall not contain any of the following:
1) Acrolein.
2) Acrylonitrile.
3) Antimony.
4) Benzene.
5) Butyl benzyl phthalate.
6) Cadmium.
7) Di (2-ethylhexyl) phthalate.
8) Di-n-butyl phthalate.
9) Di-n-octyl phthalate.
10) 1,2-dichlorobenzene.
11) Diethyl phthalate.
12) Dimethyl phthalate.
13) Ethylbenzene.
14) Formaldehyde.
15) Hexavalent chromium.
16) Isophorone.
17) Lead.
18) Mercury.
19) Methyl ethyl ketone.

20) Methyl isobutyl ketone.
21) Methylene chloride.
22) Naphthalene.
23) Toluene (methylbenzene).
24) 1,1,1-trichloroethane.
25) Vinyl chloride.

4. Colors and Patterns: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in color schedule, **as directed**.

B. Fillers And Primers
1. General: Undercoatings recommended in writing for use in coating systems by manufacturer of multicolor interior coating on substrates and under conditions indicated.
2. Latex Block Filler: Waterborne, high-solids, emulsion-type, pigmented coating product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, with bridging and filling properties, and formulated for filling surfaces of CMU for subsequent applications of finish coatings.
   a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**, according to requirements for MPI #4.
3. Wood Filler Paste: Solvent-based, high-solids, clear paste product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, for use on open-grained or damaged woods and that fills hardwood pores with minimal surface residues and without showing cracking or shrinkage. When dry, sanding filler produces a smooth surface without clogging or gumming sandpaper.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #91.
4. Wood-Knot Sealer: White shellac or other sealer recommended in writing for this purpose by manufacturer of multicolor interior coating.
5. Primer/Sealer for Multicolor Systems: Acrylic or acrylic/polyvinyl acetate (PVA) co-polymer emulsion-type, pigmented primer/sealer product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating.
   a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**, according to requirements for MPI #125.
6. Interior Alkyd Primer/Sealer: Solvent-based, pigmented primer/sealer.
   a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**, according to requirements for MPI #45.
7. Water-Based Bonding Primer: Water-based, emulsion-type, pigmented primer product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, and formulated to promote adhesion of subsequent coatings.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #17.
8. Solvent-Based Bonding Primer: Solvent-based, pigmented product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, and formulated to promote adhesion of subsequent coatings to substrate.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #69.

C. Multicolor Coatings
1. Multicolor Coatings: Complying with MPI #112 and listed in "MPI Approved Products List."
   a. VOC Content: Minimum E Range of E1 **OR** E3, **as directed**.
2. Clear Topcoat: Product of multicolor coating manufacturer complying with MPI #121 and listed in "MPI Approved Products List."
   a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.

1.3 EXECUTION

A. Preparation
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible primers, paints, and encapsulants.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
7. Wood Substrates:
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of knot sealer before applying primer.
   b. Sand surfaces that will be exposed to view and dust off.
   c. Prime edges, ends, faces, undersides, and back sides of wood.
   d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

B. Application
1. Apply coatings according to manufacturer's written instructions using applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Apply coating systems to produce uniformly textured, colored, and patterned finished-surface films without substrates, undercoats, marks, or stains showing through. Produce sharp, even glass lines and color breaks.

C. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

D. Multicolor Interior Coating Schedule
1. Vertical Concrete Substrates: System below corresponds to MPI INT 3.1H
   a. Prime Coat: Primer/sealer for multicolor systems.

b. Multicolor Base Coat: Multicolor coating, MPI #112.
c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.

2. Cementitious Composition Board Substrates: System below corresponds to MPI INT 3.3F
   a. Prime Coat: Primer/sealer for multicolor systems.
   b. Multicolor Base Coat: Multicolor coating, MPI #112.
   c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
3. Clay Masonry Units Substrates: System below corresponds to MPI INT 4.1H
   a. Prime Coat: Primer/sealer for multicolor systems tinted to match multicolor basecoat.
   b. Multicolor Base Coat: Multicolor coating, MPI #112.
   c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
4. CMU Substrates: System below corresponds to MPI INT 4.2H
   a. Block Filler: Latex block filler.
   b. Prime Coat: Primer/sealer for multicolor systems.
   c. Multicolor Base Coat: Multicolor coating, MPI #112.
   d. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   e. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
5. Wood Substrates: System below corresponds to MPI INT 6.2E, MPI INT 6.3N, and MPI INT 6.4L
   a. Fill Coat: Wood filler paste (Fill coat is optional component and is for use on open-grained woods where a smooth, glasslike finish is desired).
   b. Prime Coat: Interior alkyd primer/sealer tinted to match multicolor base coat {for dressed lumber (finished carpentry)}.
   c. Multicolor Base Coat: Multicolor coating, MPI #112.
   d. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   e. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
6. Fiberglass Molding and Trim Substrates: System below corresponds to MPI INT 6.7G
   a. Prime Coat: Water-based **OR** Solvent-based, **as directed**, bonding primer.
   b. Multicolor Base Coat: Multicolor coating, MPI #112.
   c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
7. Plastic Molding and Trim Substrates: System below corresponds to MPI INT 6.8D
   a. Prime Coat: Solvent-based bonding primer.
   b. Multicolor Base Coat: Multicolor coating, MPI #112.
   c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
8. Plaster **OR** Gypsum Veneer Plaster **OR** Gypsum Board, **as directed**, Substrates: System below corresponds to MPI INT 9.2G
   a. Prime Coat: Primer/sealer for multicolor systems.
   b. Multicolor Base Coat: Multicolor coating, MPI #112.
   c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
   d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.

END OF SECTION 09 91 23 00a

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Task	Specification	Specification Description
09 91 23 00	09 91 13 00	Exterior Painting
09 91 33 00	09 91 13 00a	Wood Stains and Transparent Finishes
09 91 33 00	09 91 13 00b	High-Temperature-Resistant Coatings

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SECTION 09 93 23 13 - FLOOR TREATMENT REFINISHING WOOD FLOORS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for refinishing wood floors. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

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

C. Quality Assurance
1. Build mockup of typical flooring area as shown on Drawings including base and shoe moldings.
   a. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.2 PRODUCTS

A. Cleaning Compound: A liquid chemical cleaner containing non-ionic and anionic type detergents, non-reactive to wood flooring. Compound shall have no free metal alkalies, no artificial coloring and no fatty acids. Compound shall be UL listed as "slip-resistant."

B. Varnish Remover: Non-flammable paint and varnish remover.

C. Stain: Penetrating type non-fading wood stain.

D. Wood Filler: Paste type wood filler, pigmented if necessary to match sample, complying with Fed. Spec. TT-F-336.

E. Floor Sealer: Penetrating type, pliable, wood-hardening finish/sealer.

F. Floor Varnish: Alkyd resin varnish, specially compounded for floor finish, Fed. Spec. TT-V-109.

G. Urethane Finish: Specially compounded for wood floor finish, moisture curing type, for multiple-coat application.

H. Floor Wax: Liquid, solvent-type, slip-resistant, CID A-A-1550, Type II.

1.3 EXECUTION

A. Preparation:
1. Cleaning: Scrub thoroughly with cleaning compound and warm water. Rinse with clean water, mop dry, and buff with polishing machine.
2. Varnish Removal: Apply paint and varnish remover as required.

3. Sanding: Traverse floors two times with an electric-powered sanding machine. A rotary disc sander may be used for the final cut, but first cut shall be made with a drum-type machine. The first cut may be made crosswise of the grain or at a 45-degree angle. Make second cut in direction of grain. Use No. 1/2 sandpaper for first traverse and No. 0 for second traverse. Use an electric edger or hand sander for sanding areas near walls, in corners, and small closets.

B. Installation:
1. Apply Wood Paste Filler, followed by wiping cross-grain to work into pores and cracks.
2. Apply Stain if needed to match selected finish.
3. Apply Sealer (2 coats) complying with Fed. Spec. TT-S-176. Use Class I for white oak and red oak floors and Class II for beech, birch, and hard maple floors.
4. Apply Floor Varnish, (3 coats) buffing after each coat. First coat may be thinned as a sealer.
5. Apply Urethane Finish. Apply as many coats as needed to build a dry film thickness of 1.0 mil.
6. When Floors are Dry, apply two coats of wax complying with Fed. Spec. P-W-155; concentration 12 percent. Spread the wax at the rate of 1,500 square feet per gallon and polish the floors with a weighted floor brush or an electric polisher.
7. Protection: Upon completion of work, cover all traffic areas immediately with nonstaining kraft paper or polyethylene, taped along edges, and maintain floor protection until acceptance.

END OF SECTION 09 93 23 13

Task	Specification	Specification Description
09 93 23 13	09 91 13 00a	Wood Stains and Transparent Finishes
09 93 23 53	09 93 23 13	Floor Treatment Refinishing Wood Floors
09 93 23 53	09 91 13 00a	Wood Stains and Transparent Finishes

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SECTION 09 96 00 00 - HIGH-PERFORMANCE COATINGS

1.1 GENERAL

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

B. Summary
1. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
   a. Exterior Substrates:
      1) Concrete, vertical and horizontal surfaces.
      2) Clay masonry.
      3) Concrete masonry units (CMU).
      4) Steel.
      5) Galvanized metal.
      6) Aluminum (not anodized or otherwise coated).
      7) Wood.
   b. Interior Substrates:
      1) Concrete, vertical and horizontal surfaces.
      2) Clay masonry.
      3) Concrete masonry units (CMU).
      4) Steel.
      5) Galvanized metal.
      6) Aluminum (not anodized or otherwise coated).
      7) Wood.
      8) Gypsum board.

C. Submittals
1. Product Data: For each type of product indicated.
2. Samples: For each type of finish-coat product indicated.
3. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.
4. LEED Submittals:
   a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance
1. Master Painters Institute (MPI) Standards:
   a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.
2. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   a. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
      1) Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      2) Other Items: Architect will designate items or areas required.

b. Final approval of color selections will be based on mockups.
   1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling
1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   a. Maintain containers in clean condition, free of foreign materials and residue.
   b. Remove rags and waste from storage areas daily.

F. Project Conditions
1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. High-Performance Coatings, General
1. Material Compatibility:
   a. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   b. Provide products of same manufacturer for each coat in a coating system.
2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
   b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
   c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
   d. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
   e. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
   f. Floor Coatings: VOC not more than 100 g/L.
   g. Shellacs, Clear: VOC not more than 730 g/L.
   h. Shellacs, Pigmented: VOC not more than 550 g/L.
   i. Stains: VOC content of not more than 250 g/L.
   j. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
   k. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.
   l. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   m. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
   n. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
   o. Floor Coatings: VOC not more than 100 g/L.
   p. Shellacs, Clear: VOC not more than 730 g/L.
   q. Shellacs, Pigmented: VOC not more than 550 g/L.
   r. Stains: VOC not more than 250 g/L.
   s. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
   t. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.

u. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
   b. Restricted Components: Paints and coatings shall not contain any of the following:
      1) Acrolein.
      2) Acrylonitrile.
      3) Antimony.
      4) Benzene.
      5) Butyl benzyl phthalate.
      6) Cadmium.
      7) Di (2-ethylhexyl) phthalate.
      8) Di-n-butyl phthalate.
      9) Di-n-octyl phthalate.
      10) 1,2-dichlorobenzene.
      11) Diethyl phthalate.
      12) Dimethyl phthalate.
      13) Ethylbenzene.
      14) Formaldehyde.
      15) Hexavalent chromium.
      16) Isophorone.
      17) Lead.
      18) Mercury.
      19) Methyl ethyl ketone.
      20) Methyl isobutyl ketone.
      21) Methylene chloride.
      22) Naphthalene.
      23) Toluene (methylbenzene).
      24) 1,1,1-trichloroethane.
      25) Vinyl chloride.
4. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in color schedule, **as directed**.

B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI#4.
   a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**.
2. Epoxy Block Filler: MPI #116.
   a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.

C. Interior Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
   a. Environmental Characteristics:
      1) VOC Content:
         a) Minimum E Range of E2 **OR** E3, **as directed**.
         b) Meets or exceeds LEED requirements for VOC content.
      2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR** 3, **as directed**.
2. Interior Alkyd Primer/Sealer: MPI #45.
   a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
3. Interior Latex-Based Wood Primer: MPI #39.
   a. Environmental Characteristics:
      1) VOC Content:
         a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.

b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR** 2 **OR** 3, **as directed**.

4. Wood-Knot Sealer: White shellac or other sealer recommended in writing by manufacturer for this purpose.

D. Metal Primers
1. Inorganic Zinc Primer: MPI #19.
a. VOC Content: Minimum E Range of 0 **OR** E1 **OR** E2 **OR** E3, **as directed**.
2. Epoxy Zinc Primer: MPI #20.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Rust-Inhibitive Primer (Water Based): MPI #107.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR** 2 **OR** 3, **as directed**.
4. Cold-Curing Epoxy Primer: MPI #101.
a. VOC Content: Minimum E Range of E1 **OR** E3, **as directed**.
5. Alkyd Anticorrosive Metal Primer: MPI #79.
a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
6. Quick-Dry Alkyd Metal Primer: MPI #76.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
7. Cementitious Galvanized-Metal Primer: MPI #26.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
8. Waterborne Galvanized-Metal Primer: MPI #134.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR** 2 **OR** 3, **as directed**.
9. Quick-Drying Primer for Aluminum: MPI #95.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
10. Vinyl Wash Primer: MPI #80.
a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**.

E. Water-Based, Light-Industrial Coatings
1. Gloss, Water-Based, Light-Industrial Coating: MPI #110-G6.
a. Environmental Characteristics:
1) VOC Content: Minimum E Range of E2.
2) Environmental Performance Rating (EPR): Minimum EPR 2.
2. Semigloss, Water-Based, Light-Industrial Coating: MPI #110-G5.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR** 3, **as directed**.
3. Eggshell, Water-Based, Light-Industrial Coating: MPI #110-G3.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR** 3, **as directed**.

F. Epoxy Coatings
1. Epoxy, Cold-Cured, Gloss: MPI #77.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Water-Based Epoxy (Interior and Exterior): MPI #115.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. High-Build Epoxy Marine Coating, Low Gloss: MPI #108.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Epoxy Deck Coating: MPI #82.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
5. Water-Based Epoxy Floor Paint: MPI #93.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR** 2 **OR** 3, **as directed**.

G. Polyurethane Coatings
1. Polyurethane, Two-Component, Pigmented, Gloss: MPI #72.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Two-Component, Aliphatic Polyurethane, Clear: MPI #78.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Polyurethane, Moisture Cured, Clear, Gloss: MPI #31.
a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Polyurethane, Moisture Cured, Clear, Flat: MPI #71.
a. VOC Content: Minimum E Range of E2.

H. Interior High-Performance Architectural Latex Coatings
1. High-Performance Architectural Latex, Velvet Finish: MPI #138, Gloss Level 2.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 4 **OR** 5 **OR** 6, **as directed**.
2. High-Performance Architectural Latex, Eggshell Finish: MPI #139, Gloss Level 3.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 5 **OR** 6, **as directed**.
3. High-Performance Architectural Latex, Satin Finish: MPI #140, Gloss Level 4.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E1 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 4.5 **OR** 6.5, **as directed**.
4. High-Performance Architectural Latex, Semigloss Finish: MPI #141, Gloss Level 5.
a. Environmental Characteristics:
1) VOC Content:
a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
b) Meets or exceeds LEED requirements for VOC content.
2) Environmental Performance Rating (EPR): Minimum EPR 5 **OR** 6 **OR** 7, **as directed**.

I. Wood Stains

1. Exterior Semitransparent Stain (Solvent Based): MPI #13.
   a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
2. Interior Wood Stain, Semitransparent (Solvent Based): MPI #90.
   a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.

1.3 EXECUTION

A. Preparation
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
   a. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   a. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10 350 to 27 580 kPa) at 6 to 12 inches (150 to 300 mm) **OR** 4000 to 10,000 psi (27 580 to 68 950 kPa), **as directed**.
      OR
      Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   a. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa) **OR** 1500 to 4000 psi (10 350 to 27 580 kPa), **as directed**, at 6 to 12 inches (150 to 300 mm).
6. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
7. Steel Substrates (for field applied primers): Remove rust and loose mill scale.
   a. Clean using methods recommended in writing by coating manufacturer.

      Blast clean according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning **OR** SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning," **as directed**.
8. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
9. Aluminum Substrates: Remove surface oxidation.
10. Wood Substrates:
    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of knot sealer before applying primer.
    b. Sand surfaces that will be exposed to view and dust off.
    c. Prime edges, ends, faces, undersides, and back sides of wood.
    d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

B. Application
1. Apply high-performance coatings according to manufacturer's written instructions.
   a. Use applicators and techniques suited for coating and substrate indicated.
   b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
3. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
4. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

C. Field Quality Control
1. The following procedure may be requested at any time and as often as the Owner deems necessary during the period when coatings are being applied:
   a. Engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will perform tests for compliance with specified requirements.
   c. the Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

E. Exterior High-Performance Coating Schedule
1. Coating systems in this Article are based on "MPI Architectural Painting Specification Manual." For renovation projects, consult "MPI Maintenance Repainting Manual" and revise coating systems accordingly.
2. Concrete Substrates, Vertical Surfaces:
   a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 3.1C):
      1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
      2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
      3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
   b. Epoxy Coating System (System below corresponds to MPI EXT 3.1D):
      1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.

2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 3.1E):
1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

3. Concrete Substrates, Horizontal Surfaces (System below corresponds to MPI EXT 3.2C):
a. Epoxy Slip-Resistant Deck Coating System:
1) Topcoat: Epoxy deck coating, MPI #82.

4. Clay-Masonry Substrates (System below corresponds to MPI EXT 4.1C):
a. Water-Based, Light-Industrial Coating System:
1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

b. Epoxy Coating System (System below corresponds to MPI EXT 4.1D) (MPI recommends this system for smooth brick.):
1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
2) Intermediate Coat : Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 4.1E) (MPI recommends this system for smooth brick.):
1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

d. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 4.1J):
1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

5. CMU Substrates:
a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 4.2C):
1) Prime Coat: Interior/exterior latex block filler, MPI #4.
2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

b. Epoxy Coating System (System below corresponds to MPI EXT 4.2E):
1) Block Filler: Epoxy block filler, MPI #116.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 4.2F):
1) Block Filler: Epoxy block filler, MPI #116.
2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

d. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 4.2G):
   1) Block Filler: Epoxy block filler, MPI #116.
   2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
   3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

6. Steel Substrates:
   a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.1B, MPI EXT 5.1C, MPI EXT 5.1M and MPI EXT 5.1N, depending on primer selected):
      1) Prime Coat: Inorganic zinc primer, MPI #19 **OR** Alkyd anticorrosive metal primer, MPI #79 **OR** Rust-inhibitive primer, (water based), MPI #107 **OR** Cold-curing epoxy primer, MPI #101, **as directed**, primer.
      2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat (intermediate coat is required for coating systems except MPI Custom Grade system using inorganic zinc primer).
      3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
   b. High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1F):
      1) Prime Coat: Cold-curing epoxy primer, MPI #101.
      2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
      3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
   c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 5.1E):
      1) Prime Coat: Rust-inhibitive primer, (water based), MPI #107.
      2) Intermediate Coat: Water-based epoxy (interior and exterior), MPI #115.
      3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
   d. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 5.1H):
      1) Prime Coat: Cold-curing epoxy primer, MPI #101.
      2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
   e. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 5.1P)
      1) Prime Coat: Epoxy zinc primer, MPI#20.
      2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
   f. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1G):
      1) Prime Coat: Epoxy zinc primer, MPI#20.
      2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
   g. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1J):
      1) Prime Coat: Cold-curing epoxy primer, MPI #101.
      2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
   h. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1L):
      1) Prime Coat: Inorganic zinc primer, MPI #19.
      2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

7. Galvanized-Metal Substrates:
   a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.3G and MPI EXT 5.3J, depending on primer selected):
      1) Prime Coat: Cementitious galvanized-metal primer, MPI #26 **OR** Waterborne galvanized-metal primer, MPI #134, **as directed**.
      2) Intermediate Coat (for Premium Grade system): Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
      3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
   b. Epoxy Coating System (System below corresponds to MPI EXT 5.3C) (MPI recommends this system for high-contact and -traffic areas.):
      1) Prime Coat: Cold-curing epoxy primer, MPI #101.
      2) Intermediate Coat (for Premium Grade system): Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
      3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
   c. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.3D) (MPI recommends these systems for high-contact and -traffic areas.):
      1) Prime Coat: Vinyl wash primer, MPI #80.
      2) Intermediate Coat: Not required **OR** Cold-curing epoxy primer, MPI #101, **as directed**.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
   d. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.3L):
      1) Prime Coat: Cold-curing epoxy primer, MPI #101.
      2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
8. Aluminum (Not Anodized or Otherwise Coated) Substrates:
   a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.4G):
      1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
      2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
      3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
   b. Epoxy Coating System (System below corresponds to MPI EXT 5.4E):
      1) Prime Coat: Vinyl wash primer, MPI #80.
      2) Intermediate Coat (for Premium Grade system): Epoxy, cold-cured, gloss, MPI #77.
      3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
   c. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.4B) (MPI recommends these systems for high-contact and -traffic areas.):
      1) Prime Coat: Vinyl wash primer, MPI #80.
      2) Intermediate Coat: Cold-curing epoxy primer, MPI #101.
      3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
9. Wood Substrates:
   a. Pigmented Polyurethane Coating System (System below corresponds to MPI EXT 6.1J, MPI EXT 6.2J, and MPI EXT 6.3H):
      1) Prime Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      2) Intermediate Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
      3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

b. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI EXT 6.1E for use on glue-laminated beams and columns):
   1) Stain Coat: Exterior semitransparent stain (solvent based), MPI #13.
   2) Intermediate Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
   3) First Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
   4) Second Topcoat (for Premium Grade systems): Two-component, aliphatic polyurethane, clear, MPI #78.

F. Interior High-Performance Coating Schedule
1. Coating systems in this Article are based on "MPI Architectural Painting Specification Manual." For renovation projects, consult "MPI Maintenance Repainting Manual" and revise coating systems accordingly.
2. Concrete Substrates, Vertical Surfaces (System below corresponds to MPI INT 3.1C):
   a. High-Performance Architectural Latex Coating System:
      1) Prime Coat: Interior latex primer/sealer, MPI #50.
      2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
      3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
   b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 3.1L):
      1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
      2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
      3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
   c. Epoxy Coating System (System below corresponds to MPI INT 3.1F.) (MPI recommends this system for smooth concrete.):
      1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
      2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
      3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
   d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 3.1G) (MPI recommends this system for smooth concrete.):
      1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
      2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
      3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
3. Concrete Substrates, Horizontal Surfaces.
   a. Epoxy Coating System (System below corresponds to MPI INT 3.2C):
      1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
      2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
      3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
   b. Water-Based Epoxy Floor Paint Coating System (System below corresponds to MPI INT 3.2L).
      1) Prime Coat: Water-based epoxy floor paint, MPI #93.
      2) Intermediate Coat: Not required **OR** Water-based epoxy floor paint, MPI #93, **as directed**.
      3) Topcoat: Water-based epoxy floor paint, MPI #93.
   c. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 3.2D):
      1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
      2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.

3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

d. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 3.2K):
1) Prime Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.

4. Clay-Masonry Substrates:
a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 4.1L):
1) Prime Coat: High-performance architectural latex matching topcoat.
2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 4.1C):
1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. Epoxy Coating System (System below corresponds to MPI INT 4.1F) (MPI recommends this system for smooth brick.):
1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 4.1G) (MPI recommends this system for smooth brick.):
1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

e. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 4.1K):
1) Prime Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.

5. CMU Substrates:
a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 4.2D):
1) Prime Coat: Interior/exterior latex block filler, MPI #4.
2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 4.2K):
1) Prime Coat: Interior/exterior latex block filler, MPI #4.

2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. Epoxy Coating System (System below corresponds to MPI INT 4.2F and MPI INT 4.2G, depending on primer selected) (MPI recommends these systems for dry environments.):
1) Prime Coat: Interior/exterior latex block filler, MPI #4 **OR** Epoxy block filler, MPI #116, **as directed**.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 4.2J) (MPI recommends this system for wet environments.):
1) Prime Coat: Interior/exterior latex block filler, MPI #4.
2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

6. Steel Substrates:
a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 5.1R):
1) Prime Coat: Alkyd anticorrosive metal primer, MPI #79 **OR** Quick-dry alkyd metal primer, MPI #76, **as directed**.
2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.1B and MPI INT 5.1N, depending on primer selected.):
1) Prime Coat: Rust-inhibitive primer (water based), MPI #107 **OR** Cold-curing epoxy primer, MPI #101, **as directed**.
2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. High-Build Epoxy Coating System - Premium Grade (System below corresponds to MPI INT 5.1P):
1) Prime Coat: Epoxy zinc primer, MPI#20.
2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

d. High-Build Epoxy Coating System – Custom Grade (System below corresponds to MPI INT 5.1P):
1) Prime Coat: Epoxy zinc primer, MPI#20.
2) Topcoat: High-build epoxy marine coating, low gloss, MPI #108.

e. Epoxy Coating System (System below corresponds to MPI INT 5.1L):
1) Prime Coat: Cold-curing epoxy primer, MPI #101.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

f. Water-Based Epoxy Coating System (System below corresponds to MPI INT 5.1K):
1) Prime Coat: Rust-inhibitive primer (water based), MPI #107.
2) Intermediate Coat: Water-based epoxy (interior and exterior), MPI #115.
3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

g. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1F):
1) Prime Coat: Cold-curing epoxy primer, MPI #101.

2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

h. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1H):
1) Prime Coat: Inorganic zinc primer, MPI #19.
2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

i. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1J):
1) Prime Coat: Epoxy zinc primer, MPI#20.
2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

j. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI INT 5.1G):
1) Prime Coat: Cold-curing epoxy primer, MPI #101.
2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

7. Galvanized-Metal Substrates:
a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 5.3M):
1) Prime Coat: Waterborne galvanized-metal primer, MPI #134.
2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.3B and MPI INT 5.3K, depending on primer selected.):
1) Prime Coat: Cementitious galvanized-metal primer, MPI #26 **OR** Waterborne galvanized-metal primer, MPI #134, **as directed**.
2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. Epoxy Coating System (System below corresponds to MPI INT 5.3D):
1) Prime Coat: Cold-curing epoxy primer, MPI #101.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

8. Aluminum (Not Anodized or Otherwise Coated) Substrates (System below corresponds to MPI INT 5.4F):
a. High-Performance Architectural Latex Coating System:
1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
2) Intermediate Coat: Not required **OR** High-performance architectural latex, matching topcoat, **as directed**.
3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.4E):
1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. Epoxy Coating System (System below corresponds to MPI INT 5.4B):

1) Prime Coat: Vinyl wash primer, MPI #80.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

d. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.4C):
1) Prime Coat: Vinyl wash primer, MPI #80.
2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

9. Wood Substrates:
a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 6.1N, MPI INT 6.3A, and MPI INT 6.4S):
1) Prime Coat: Interior latex-based wood primer, MPI #39.
2) Intermediate Coat: High-performance architectural latex matching topcoat.
3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 6.3P and MPI INT 6.4N):
1) Prime Coat: Interior alkyd primer/sealer, MPI #45.
2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. Epoxy Coating System (System below corresponds to MPI INT 6.1L and MPI INT 6.3L):
1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

d. Pigmented Polyurethane Coating System (System below corresponds to MPI INT 6.1E):
1) Prime Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
2) Intermediate Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

e. Polyurethane, Clear, Moisture-Cured Coating System (System below corresponds to MPI INT 6.1S, MPI INT 6.2N, MPI INT 6.3Y, and MPI INT 6.4V):
1) Stain Coat: Interior wood stain, semitransparent (solvent based), MPI #90.
2) Intermediate Coat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
3) First Topcoat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
4) Second Topcoat: Not required **OR** Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.

f. Polyurethane, Clear, Moisture-Cured Coating System (System below corresponds to MPI INT 6.3X):
1) Intermediate Coat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
2) First Topcoat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
3) Second Topcoat: Not required **OR** Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.

g. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 6.3Z):
1) Stain Coat: Exterior semitransparent stain (solvent based), MPI #13.
2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.

10. Gypsum Board Substrates:

a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 9.2B):
   1) Prime Coat: Interior latex primer/sealer, MPI #50.
   2) Intermediate Coat: High-performance architectural latex matching topcoat.
   3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.

b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 9.2L):
   1) Prime Coat: Interior latex primer/sealer, MPI #50.
   2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
   3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.

c. Epoxy Coating System (System below corresponds to MPI INT 9.2E):
   1) Prime Coat: Interior latex primer/sealer, MPI #50.
   2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
   3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.

d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 9.2F):
   1) Prime Coat: Interior latex primer/sealer, MPI #50.
   2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
   3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

END OF SECTION 09 96 00 00

Task	Specification	Specification Description
09 96 53 00	09 91 13 00	Exterior Painting

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SECTION 09 96 56 00 - FIBERGLASS REINFORCED EPOXY COATING

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for fiberglass reinforced epoxy coating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals
1. Product Data: For each coating system specified.

C. Material Storage
1. Store materials in a temperature controlled environment (50ºF - 90ºF) and out of direct sunlight.
2. Keep resins, hardeners, and solvents separated from each other and away from sources of ignition. One year shelf life is expected for products stored between 50ºF - 90ºF.

1.2 PRODUCTS

A. Materials
1. Multi-Layer, High Build Wall and Ceiling Surfacing System
a. Primer
1) Water-based epoxy base coating.
b. Base Coat
1) High performance epoxy coating.
c. Fiberglass Mesh Reinforcement
1) Bound fiberglass cloth, 5.6 oz.
d. Saturant
1) High performance epoxy coating.
e. Level Coat
1) High performance epoxy coating.
f. Chemical Resistant Finish Coat
1) 100% solids polyurethane.

1.3 EXECUTION

A. Primer
1. Mixing and Application: Water Based Epoxy Wall Coating should only be used on unpainted, porous surfaces. If the surface is painted with latex or an epoxy coating, clean and abrade the surface then apply the primer.
2. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to whip air into the materials.
3. Add 2 parts resin to 1 part hardener, mix with low speed drill and Jiffy mixer for three minutes and until uniform. Apply material using a 1/4" short nap roller at a spread rate of 300-350 sq. ft. per gallon to yield 5 mils WFT.
4. Allow to cure for a minimum of 3 hours depending upon air movement. Lightly "pole sand" smooth rough edges of the flake before applying base coat.

B. Base Coat
1. Mixing and Application

a. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
b. Add 3 parts resin to 1 part hardener by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
c. Base coat may be applied via spray, roller or brush. Apply using a 1/4" nap roller at a spread rate of 200-250 sq. ft. per gallon to yield 6-8 mils WFT evenly with no runs. Coverage will vary depending upon porosity of the substrate and surface texture.

C. Fiberglass Reinforcement
1. Apply 5.6 oz. bound fiberglass cloth for walls and 4 oz. for ceilings directly into wet resin. Do not allow material to cure or recoating will be necessary.
2. Hang fiberglass cloth directly to the wall similar to hanging wallpaper so seams are uniform and even. Overlap each strip using a double cut method. Remove the trimmed material behind the front strip.
3. After hand affixing to wall, use a broad knife to remove air pockets, wrinkles or any irregularities.

D. Saturant Coat
1. Mixing and Application
a. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
b. Add 3 parts 3548PA (resin) to 1 part 3548B (hardener) by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
c. Saturant coat may be applied via spray, roller or brush. Apply at a spread rate of 250-400 sq. ft. per gallon to yield 4-6 mils WFT evenly with no runs. Allow to cure overnight (minimum 10 hours) before lightly sanding seams, bumps and other imperfections with 60-80 grit sandpaper caused by the saturant coat.

E. Level Coat
1. Mixing and Application
a. Apply leveling coat as described in previous step.
b. Allow to cure overnight.
c. An additional level coat may be applied.
d. Sand any imperfections prior to applying finish coat.

F. Finish Coat
1. Mixing and Application
a. Premix resin using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
b. Add 1 part resin to 1 part hardener by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
c. Finish coat may be applied via spray, roller or brush. Apply using a 1/4" nap non-shedding, urethane enamel roller at a spread rate of 250-400 sq. ft. per gallon to yield 4-6 WFT mils evenly with no runs. If second coat is required, the surface must be abraded with 80-120 grit paper or screen and tack wiped prior to second application.
d. Allow to cure 48 hours for water exposure and 7 days for chemical exposure. In cool and/or high humidity conditions, a surface film may form which can be washed with soap and water.

END OF SECTION 09 96 56 00

Task	Specification	Specification Description
09 96 56 00	09 96 00 00	High-Performance Coatings

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SECTION 09 96 66 00 - CEMENTITIOUS COATINGS

1.1 GENERAL

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

B. Summary
1. Section includes surface preparation and application of cementitious coating systems on the following substrates:
   a. Exterior and Interior concrete.
   b. Exterior and Interior concrete masonry units.
   c. Exterior and Interior brick.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittal:
   a. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content and chemical components.
3. Samples: In each color and gloss of finish coat indicated.
   a. Submit Samples on rigid backing **OR** actual substrate, **as directed**, not less than 4 by 8 inches (100 by 200 mm), with mortar joint in center, **as directed**.
   b. Step coats on Samples to show each coat required for system.
   c. Label each coat of each Sample.
4. Material Certificates: For each cementitious coating, from manufacturer.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency, for each product formulation.

D. Quality Assurance
1. Source Limitations: Obtain cementitious coating materials from single source from single manufacturer.
2. Mockups: Apply benchmark samples of coating system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   a. Architect will select one actual substrate of each type to represent surfaces and conditions for application of coating.
      1) Wall Surfaces: Prepare samples of at least 100 sq. ft. (9.3 sq. m).
   b. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   c. Final approval of color selections will be based on benchmark samples.
      1) If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

E. Delivery, Storage, And Handling
1. Deliver materials to Project site in manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label, and the following information:
   a. Product name or title of material.
   b. Manufacturer's stock number and date of manufacture.
   c. Contents by volume, for pigment and vehicle constituents.
   d. Application instructions.

e. Color name and number.
f. Handling instructions and precautions.

2. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
   a. Protect cementitious coating materials from freezing. Keep materials dry and storage area neat and orderly. Remove waste daily. Take necessary measures to ensure that workers and work areas are protected from health hazards resulting from handling, mixing, and applying the coating.

F. Project Conditions
1. Apply coatings only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Cementitious Coatings
1. Polymer-Modified Cementitious Coating: Containing portland cement, polymer, and hydrated lime or aggregates.
2. Performance Requirements: Comply with the following:
   a. Compressive Strength: Not less than 3500 psi (24.1 MPa) at 28 days according to ASTM C 109/C 109M.
   b. Tensile Strength: Not less than 350 psi (2.41 MPa) at 28 days according to ASTM C 109/C 109M.
   c. Flexural Strength: as directed by the Owner.
   d. Adhesion: as directed by the Owner.
   e. Permeance: as directed by the Owner.
   f. Accelerated Weathering: as directed by the Owner.
   g. UV Resistance: as directed by the Owner.
   h. Salt-Spray Resistance: as directed by the Owner.
3. Other Materials: Provide crack fillers, block fillers, and related materials that are compatible with cementitious finish-coat materials and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
4. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:
   a. Flat Paints and Coatings: VOC content of not more than 50 g/L.
   b. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
5. Chemical Components of Interior Paints and Coatings: Provide topcoat paints that comply with the following chemical restrictions:
   a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   b. Restricted Components: Paints and coatings shall not contain any of the following:
      1) Acrolein.
      2) Acrylonitrile.
      3) Antimony.
      4) Benzene.
      5) Butyl benzyl phthalate.
      6) Cadmium.
      7) Di (2-ethylhexyl) phthalate.

8) Di-n-butyl phthalate.
9) Di-n-octyl phthalate.
10) 1,2-dichlorobenzene.
11) Diethyl phthalate.
12) Dimethyl phthalate.
13) Ethylbenzene.
14) Formaldehyde.
15) Hexavalent chromium.
16) Isophorone.
17) Lead.
18) Mercury.
19) Methyl ethyl ketone.
20) Methyl isobutyl ketone.
21) Methylene chloride.
22) Naphthalene.
23) Toluene (methylbenzene).
24) 1,1,1-trichloroethane.
25) Vinyl chloride.

6. Colors: As selected from manufacturer's full range **OR** As indicated in a color schedule, **as directed**.

1.3 EXECUTION

A. Examination
1. Examine substrates and conditions, with Applicator present, for compliance with requirements and other conditions affecting performance of the Work.
2. Verify suitability of substrates, including surface conditions and compatibility.
3. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
a. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

B. Preparation
1. Comply with manufacturer's written instructions for mixing and preparing materials and as applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
a. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, incompatible coatings, and loose substrate materials.
4. Cementitious and Masonry Surfaces: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
5. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.
a. Cracks Larger Than 1/32 Inch (0.8 mm): Cut out static cracks, voids, or honeycombing larger than 1/32 inch (0.8 mm) and patch with materials recommended in writing by coating manufacturer. Identify dynamic cracks and treat according to manufacturer's written instructions before beginning application.

C. Application
1. Apply coatings according to manufacturer's written instructions. Use applicators and techniques suited for coating and substrate indicated.

a. Dampen substrate of surfaces to receive cementitious coatings one hour before beginning application to prevent surface drag. Immediately before applying coatings, redampen substrate. Substrates shall be saturated surface dry at time of application.
b. Brushes: Use tampico or masonry brushes best suited for material being applied.
c. Spray Equipment: Use spray equipment recommended in writing by manufacturer for material and texture required.

2. Apply each material at not less than manufacturer's recommended spreading rate. Provide total cured material thickness indicated or as recommended in writing by manufacturer.
3. Brush Application: Brush-out and work brush coats into surfaces in an even film, filling all pores and voids at rate recommended in writing by manufacturer to achieve cured material thickness indicated. Finish coat with smooth, horizontal strokes.
4. Spray Application: Apply each coat according to manufacturer's written instructions to provide the equivalent hiding of brush-applied coats. Follow spray application with a general light brooming of coated surface to impart a slight texture.

D. Field Quality Control
1. Testing of Coating Materials: Contractor shall invoke the following procedure at any time and as often as necessary during the period when coating operations are being conducted:
a. Engage the services of a qualified testing agency to sample coating materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
b. Testing agency will perform tests for compliance with the following product requirements.
1) Quantitative material analysis.
2) Compressive strength.
3) Tensile strength.
4) Flexural strength.
5) Permeance.
6) Accelerated weathering.
c. the Owner may direct Contractor to stop coating application if test results show materials being used do not comply with requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

E. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

F. Coating Schedule
1. General: Apply additional coats when undercoats or other conditions show through final coat until cured film is of uniform coating finish, color, and appearance.
2. Above-Grade Concrete and Masonry: Two finish coats with total cured thickness not less than 40 mils (1.0 mm).
a. First Coat: Apply polymer-modified cementitious coating material at the rate of 2 lb/sq. yd. (1 kg/sq. m) to achieve a total cured thickness of 25 mils (0.6 mm).
b. Second Coat: Apply polymer-modified cementitious coating material at the rate of 1 lb/sq. yd. (0.5 kg/sq. m) to achieve a total cured thickness of 15 mils (0.4 mm).

3. Surfaces Previously Coated with Polymer-Modified Cementitious Coating: One finish coat with a total cured thickness of not less than 15 mils (0.4 mm).
   a. Apply polymer-modified cementitious coating material at the rate of 1 lb/sq. yd. (0.5 kg/sq. m) to achieve a total cured thickness of 15 mils (0.4 mm).

END OF SECTION 09 96 66 00

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Task	Specification	Specification Description
09 97 13 23	09 96 00 00	High-Performance Coatings
09 97 13 24	09 96 00 00	High-Performance Coatings
09 97 26 13	09 96 00 00	High-Performance Coatings
09 97 35 00	09 91 23 00	Interior Painting
09 97 63 00	09 96 00 00	High-Performance Coatings

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SECTION 10 01 50 11 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Knocked-down corridor lockers.
2. Welded corridor lockers.
3. Knocked-down athletic lockers.
4. Welded athletic lockers.
5. Knocked-down, open-front athletic lockers.
6. Welded, open-front athletic lockers.
7. Locks.
8. Locker benches.

B. Related Requirements:

1. Section 105113.13 "Coin-Operated Metal Lockers" for coin-operated lockers used in public facilities for temporary storage of personal belongings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker[**and bench**].

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>
3. <Double click to insert sustainable design text for composite wood.>

C. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

D. Samples: For each color specified, in manufacturer's standard size.

E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

F. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers and equipment.
2. Locker benches.

G. Product Schedule: For lockers.[**Use same designations indicated on Drawings.**]

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. The following metal locker hardware items equal to [**10**] <**Insert number**> percent of amount installed for each type and finish installed, but no fewer than [**five**] <**Insert number**> units:

a. Locks.
b. Blank identification plates.
c. Hooks.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver [**master and control keys**] [**combination control charts**] to Owner by registered mail or overnight package service[**.**][**, addressed as follows:**]

1. <**Insert name and address of Owner's representative**>.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of [**concrete**] [**concrete masonry**] [**wood**] bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: [**Two**] <**Insert number**> years from date of Substantial Completion.
4. Warranty Period for Welded Metal Lockers: [**Lifetime**] [**10 years**] <**Insert years**> from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers[**, locker benches,**] and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers[**and locker benches**] indicated to be accessible, comply with applicable provisions in [**the USDOJ's "2010 ADA Standards for Accessible Design"**] [**the ABA standards of the Federal agency having jurisdiction**] [**and**] [**ICC A117.1**] <**Insert requirement**>.

2.3 KNOCKED-DOWN CORRIDOR LOCKERS <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Doors: One piece; fabricated from [**0.060-inch (1.52-mm)**] [**0.075-inch (1.90-mm)**] nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
2. Doors for box lockers less than 15 inches (381 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.
5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
6. Door Style: [**Unperforated panel.**] [**Vented panel as follows:**]

    a. Louvered Vents: No fewer than [**six louver openings at top and bottom for single-tier**] [**three louver openings at top and bottom for double-tier**] [**two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier**] <**Insert configuration**> lockers.
    b. Security Vents: Manufacturer's standard, stamped horizontal or vertical.
    c. Perforated Vents: [**Manufacturer's standard shape and configuration**] <**Insert shape and configuration**>.
    d. Concealed Vents: Slotted perforations in top and bottom horizontal door return flanges.

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.
2. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.
3. Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
2. Frame Vents: Fabricate face frames with vents.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees[**; self-closing**].

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
2. Continuous Hinges: Manufacturer's standard, steel, full height.
3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

F. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.

1. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

G. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.

b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2. Single-Point Latching: Nonmoving latch hook [**designed to engage bolt of built-in combination or cylinder lock**] [**with steel padlock loop that projects through recessed cup and is finished to match metal locker body**].

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

H. Door Handle and Latch for [**Box**] [**16-Person**] Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

I. Locks: [**Combination padlocks**] [**Built-in combination locks**] [**Cylinder locks**] [**Built-in, card-operated locks**] [**Digital keypad locks**] [**Built-in, coin-operated locks**].

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped [**aluminum**] [**plastic**] plates, with numbers and letters at least 3/8 inch (9 mm) high.

K. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.

L. Coat Rods: [**1-inch- (25-mm-) diameter steel tube or rod, chrome finished**] [**1-inch- (25-mm-) diameter steel tube or rod, nickel plated**] [**3/4-inch- (19-mm-) diameter steel tube or rod, chrome finished**] [**3/4-inch- (19-mm-) diameter steel tube or rod, nickel plated**] [**Manufacturer's standard**].

M. Legs: [**6 inches (152 mm)**] <**Insert dimension**> high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.

1. Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.

N. Continuous Zee Base: Fabricated from [**0.060-inch (1.52-mm)**] [**0.075-inch (1.90-mm)**] [**manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm)**] nominal-thickness steel sheet.

1. Height: [**4 inches (102 mm)**] <**Insert dimension**>.

O. Continuous Sloping Tops: Fabricated from [**0.036-inch (0.91-mm)**] [**0.048-inch (1.21-mm)**] [**manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm)**] nominal-thickness steel sheet.

1. Closures: [**Vertical**] [**Hipped**]-end type.
2. Sloping-top corner fillers, mitered.

P. Individual Sloping Tops: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

Q. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

R. Filler Panels: Fabricated from [**0.036-inch (0.91-mm)**] [**0.048-inch (1.21-mm)**] [**manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm)**] nominal-thickness steel sheet.

S. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

T. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

U. Center Dividers: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

V. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. <Double click to insert sustainable design text for recycled content.>

W. Finish: Baked enamel or powder coat.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] [**Two colors, with door one color and frame and body another color; as selected by Architect from manufacturer's full range**] <**Insert color**>.

2.4 WELDED CORRIDOR LOCKERS <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
2. Door Style: [**Unperforated panel.**] [**Vented panel as follows:**]

a. Louvered Vents: No fewer than [**six louver openings at top and bottom for single-tier**] [**three louver openings at top and bottom for double-tier**] [**two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier**] <**Insert configuration**> lockers.
b. Security Vents: Manufacturer's standard, stamped horizontal or vertical.
c. Perforated Vents: [**Manufacturer's standard shape and configuration**] <**Insert shape and configuration**>.

C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Sides: 0.060-inch (1.52-mm) nominal thickness.

2. Backs: 0.048-inch (1.21-mm) nominal thickness.
3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees[**; self-closing**].

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
2. Continuous Hinges: Manufacturer's standard, steel, full height.
3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

F. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.

1. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

G. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2. Single-Point Latching: Nonmoving latch hook [**designed to engage bolt of built-in combination or cylinder lock**] [**with steel padlock loop that projects through recessed cup and is finished to match metal locker body**].

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

H. Door Handle and Latch for [**Box**] [**16-Person**] Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

I. Locks: [**Combination padlocks**] [**Built-in combination locks**] [**Cylinder locks**] [**Built-in, card-operated locks**] [**Digital keypad locks**] [**Built-in, coin-operated locks**].

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped [**aluminum**] [**plastic**] plates, with numbers and letters at least 3/8 inch (9 mm) high.

K. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

L. Coat Rods: [**1-inch- (25-mm-) diameter steel, chrome finished**] [**1-inch- (25-mm-) diameter steel, nickel plated**] [**3/4-inch- (19-mm-) diameter steel, chrome finished**] [**3/4-inch- (19-mm-) diameter steel, nickel plated**] [**Manufacturer's standard**].

M. Legs: [**6 inches (152 mm)**] <**Insert dimension**> high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.

1. Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.

N. Continuous Zee Base: Fabricated from, [**0.060-inch (1.52-mm)**] [**0.075-inch (1.90-mm)**] [**manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm)**] nominal-thickness steel sheet.

1. Height: [**4 inches (102 mm)**] <**Insert dimension**>.

O. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: [**Vertical**] [**Hipped**]-end type.

P. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

Q. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

R. Boxed End Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

S. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

T. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. <Double click to insert sustainable design text for recycled content.>

U. Finish: Baked enamel or powder coat.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] [**Two colors, with door one color and**

frame and body another color; as selected by Architect from manufacturer's full range] <**Insert color**>.

2.5 KNOCKED-DOWN ATHLETIC LOCKERS <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Perforated Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bend at [**vertical edges and with right-angle single bend at horizontal edges**] [**and**] [**latch point (bottom) and right-angle single bend at remaining edges for box lockers**].

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

C. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
2. Backs: 0.048-inch (1.21-mm) nominal thickness.
3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from [**0.048-inch (1.21-mm)**] [**0.060-inch (1.52-mm)**] nominal-thickness steel sheet.

F. Perforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations.

G. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.

H. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames for [**Double-Tier**] [**Triple-Tier**] Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

I. Reinforced Bottoms: Structural channels, formed from [**0.060-inch (1.52-mm)**] [**0.075-inch (1.90-mm)**] nominal-thickness steel sheet; welded to front and rear of side-panel frames.

J. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees[**; self-closing**].

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.

2. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.
3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

K. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2. Single-Point Latching: Nonmoving latch hook [**designed to engage bolt of built-in combination or cylinder lock**] [**with steel padlock loop that projects through recessed cup and is finished to match metal locker body**].

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

L. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.

M. Door Handle and Latch for Box Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

N. Locks: [**Combination padlocks**] [**Built-in combination locks**] [**Cylinder locks**] [**Built-in, card-operated locks**] [**Digital keypad locks**] [**Built-in, coin-operated locks**].

O. Identification Plates: Manufacturer's standard, etched, embossed, or stamped [**aluminum**] [**plastic**] plates, with numbers and letters at least 3/8 inch (9 mm) high.

P. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

Q. Coat Rods: [**1-inch- (25-mm-) diameter steel, chrome finished**] [**1-inch- (25-mm-) diameter steel, nickel plated**] [**3/4-inch- (19-mm-) diameter steel, chrome finished**] [**3/4-inch- (19-mm-) diameter steel, nickel plated**] [**Manufacturer's standard**].

R. Legs: [**6 inches (152 mm)**] <**Insert dimension**> high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.

1. Closed Front and End Bases: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

S. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

T. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: [**Vertical**] [**Hipped**]-end type.

U. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

V. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

W. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

X. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

Y. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
4. <Double click to insert sustainable design text for recycled content.>

Z. Finish: Baked enamel or powder coat.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] [**Two colors, with door one color and frame and body another color; as selected by Architect from manufacturer's full range**] <**Insert color**>.

2.6 WELDED ATHLETIC LOCKERS <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Perforated Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bend at [**vertical edges and with right-angle single bend at horizontal edges**] [**and**] [**latch point (bottom) and right-angle single bend at remaining edges for box lockers**].

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

C. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
2. Backs: 0.048-inch (1.21-mm) nominal thickness.

3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from [**0.048-inch (1.21-mm)**] [**0.060-inch (1.52-mm)**] nominal-thickness steel sheet.

F. Perforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations.

G. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.

H. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames for [**Double-Tier**] [**Triple-Tier**] Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

I. Reinforced Bottoms: Structural channels, formed from [**0.060-inch (1.52-mm)**] [**0.075-inch (1.90-mm)**] nominal-thickness steel sheet; welded to front and rear of side-panel frames.

J. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees[**; self-closing**].

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
2. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.
3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

K. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic latching and prelocking.

   a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
   b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2. Single-Point Latching: Nonmoving latch hook [**designed to engage bolt of built-in combination or cylinder lock**] [**with steel padlock loop that projects through recessed cup and is finished to match metal locker body**].

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

L. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.

M. Door Handle and Latch for Box Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

N. Locks: [**Combination padlocks**] [**Built-in combination locks**] [**Cylinder locks**] [**Built-in, card-operated locks**] [**Digital keypad locks**] [**Built-in, coin-operated locks**].

O. Identification Plates: Manufacturer's standard, etched, embossed, or stamped [**aluminum**] [**plastic**] plates, with numbers and letters at least 3/8 inch (9 mm) high.

P. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

Q. Coat Rods: [**1-inch- (25-mm-) diameter steel, chrome finished**] [**1-inch- (25-mm-) diameter steel, nickel plated**] [**3/4-inch- (19-mm-) diameter steel, chrome finished**] [**3/4-inch- (19-mm-) diameter steel, nickel plated**] [**Manufacturer's standard**].

R. Legs: [**6 inches (152 mm)**] <**Insert dimension**> high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.

1. Closed Front and End Bases: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

S. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

T. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: [**Vertical**] [**Hipped**]-end type.

U. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

V. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

W. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

X. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

Y. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

4. <Double click to insert sustainable design text for recycled content.>

Z. Finish: Baked enamel or powder coat.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] [**Two colors, with door one color and frame and body another color; as selected by Architect from manufacturer's full range**] <**Insert color**>.

2.7 KNOCKED-DOWN, OPEN-FRONT ATHLETIC LOCKERS <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Locker Arrangement: Open front, with [**seat/shelf**] [**seat/footlocker**] [**upper shelf**] [**upper shelf with security box**] [**and**] [**full-width security compartment**] [**configuration as indicated on Drawings**].

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
2. Backs: 0.048-inch (1.21-mm) nominal thickness.
3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

D. Unperforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

E. Perforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations. Perforations shall not occur [**above upper shelf**] [**at security compartment**] [**or**] [**at seat/footlocker**].

F. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.

G. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.105-inch (2.66-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames.

H. Reinforced Bottoms: Structural channels, formed from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.

I. Seats/Shelves: Full width of metal locker; channel formed; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; with stiffeners for reinforcement.

J. Seats/Footlockers: Enclosure full width of bottom of metal locker; fabricated from cold-rolled steel sheet.

1. Seat/Lid: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed and reinforced with stiffeners; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when seat/lid is closed; with padlock hasp.
2. Front Panel: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed at top edge; with minilouvers for ventilation; recessed for padlock loop.
3. Sides: [**Integral part of unperforated**] [**Unperforated bottom portions of perforated**] [**0.060-inch (1.52-mm) nominal-thickness steel sheet inside expanded-metal**] sides.

K. Security Boxes: Nonperforated, consisting of partition extending from upper shelf to top of metal locker, fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; with channel-formed, 0.060-inch (1.52-mm) nominal-thickness, steel sheet door frame, and door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with right-angle single bend at edges; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Single-Point Latching: Stainless steel strike plate with integral pull; with steel, nonmoving latch hook [**designed to engage bolt of lock**] [**with steel padlock loop that projects through door and is finished to match metal locker body**].
2. Locks: [**Combination padlocks**] [**Built-in combination locks**] <**Insert item**>.

L. Security Compartments: Nonperforated, running full width of metal locker, with door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

1. Locks: [**Combination padlocks**] [**Built-in combination locks**] <**Insert item**>.

M. Identification Plates: Manufacturer's standard, etched, embossed, or stamped [**aluminum**] [**plastic**] plates, with numbers and letters at least 3/8 inch (9 mm) high.

N. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

O. Coat Rods: [**1-inch- (25-mm-) diameter steel, chrome finished**] [**1-inch- (25-mm-) diameter steel, nickel plated**] [**3/4-inch- (19-mm-) diameter steel, chrome finished**] [**3/4-inch- (19-mm-) diameter steel, nickel plated**] [**Manufacturer's standard**].

P. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: [**Vertical**] [**Hipped**]-end type.

Q. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

R. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

S. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

T. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

U. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
4. <Double click to insert sustainable design text for recycled content.>

V. Finish: Baked enamel or powder coat.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

2.8 WELDED, OPEN-FRONT ATHLETIC LOCKERS <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Locker Arrangement: Open front, with [**seat/shelf**] [**seat/footlocker**] [**upper shelf**] [**upper shelf with security box**] [**and**] [**full-width security compartment**] [**configuration as indicated on Drawings**].

C. Material: [**Cold-rolled**] [**Metallic-coated**] steel sheet.

D. Body: Assembled by [**welding**] [**or**] [**riveting or bolting**] body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
2. Backs: 0.048-inch (1.21-mm) nominal thickness.
3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

F. Perforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations. Perforations shall not occur [**above upper shelf**] [**at security compartment**] [**or**] [**at seat/footlocker**].

G. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.

H. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.105-inch (2.66-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames.

I. Reinforced Bottoms: Structural channels, formed from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.

J. Seats/Shelves: Full width of metal locker; channel formed; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; with stiffeners for reinforcement.

K. Seats/Footlockers: Enclosure full width of bottom of metal locker; fabricated from cold-rolled steel sheet.

1. Seat/Lid: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed and reinforced with stiffeners; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when seat/lid is closed; with padlock hasp.
2. Front Panel: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed at top edge; with minilouvers for ventilation; recessed for padlock loop.
3. Sides: [**Integral part of unperforated**] [**Unperforated bottom portions of perforated**] [**0.060-inch (1.52-mm) nominal-thickness steel sheet inside expanded-metal**] sides.

L. Security Boxes: Nonperforated, consisting of partition extending from upper shelf to top of metal locker, fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; with channel-formed, 0.060-inch (1.52-mm) nominal-thickness, steel sheet door frame, and door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with right-angle single bend at edges; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Single-Point Latching: Stainless steel strike plate with integral pull; with steel, nonmoving latch hook [**designed to engage bolt of lock**] [**with steel padlock loop that projects through door and is finished to match metal locker body**].
2. Locks: [**Combination padlocks**] [**Built-in combination locks**] <**Insert item**>.

M. Security Compartments: Nonperforated, running full width of metal locker, with door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

1. Locks: [**Combination padlocks**] [**Built-in combination locks**] <**Insert item**>.

N. Identification Plates: Manufacturer's standard, etched, embossed, or stamped [**aluminum**] [**plastic**] plates, with numbers and letters at least 3/8 inch (9 mm) high.

O. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

P. Coat Rods: [**1-inch- (25-mm-) diameter steel, chrome finished**] [**1-inch- (25-mm-) diameter steel, nickel plated**] [**3/4-inch- (19-mm-) diameter steel, chrome finished**] [**3/4-inch- (19-mm-) diameter steel, nickel plated**] [**Manufacturer's standard**].

Q. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: [**Vertical**] [**Hipped**]-end type.

R. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

S. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

T. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

U. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

V. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
4. <Double click to insert sustainable design text for recycled content.>

W. Finish: Baked enamel or powder coat.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

2.9 LOCKS

A. Combination Padlock: [**Key-controlled, three-number dialing combination locks; capable of five combination changes**] [**Provided by Owner**].

B. Built-in Combination Lock: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.

1. Bolt Operation: [**Manually locking deadbolt**] [**or**] [**automatically locking spring bolt**].

C. Cylinder Lock: Built-in, flush, cam lock with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and [**two**] <**Insert number**> master keys.

1. Key Type: [**Flat**] [**Grooved**][**, with minimum 2- by 2.68-inch (51- by 68.3-mm) key head for accessible lockers**].
2. Bolt Operation: [**Manually locking deadbolt**] [**or**] [**automatically locking spring bolt**].

D. Built-in, Card-Operated Lock: Self-contained units mounted on interior of door with replaceable lock cylinders keyed separately and master keyed. Mount instruction decals on both door faces. Furnish one change card key for each lock and one master card key.

1. Bolt Operation: [**Manually locking deadbolt**] [**or**] [**automatically locking spring bolt**].

E. Digital Keypad Lock: Battery-powered electronic keypad with reprogrammable manager and owner codes that override access. Three consecutive incorrect code entries shall disable lock for three minutes.

1. Designed for permanently assigned access via entry of user's four-digit code.
2. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.

F. Built-in, Coin-Operated Lock: Self-contained units mounted on interior of door with replaceable lock cylinders keyed separately and master keyed. Mount instruction decals on both door faces. Furnish one change key for each lock and one master key.

1. Bolt Operation: [**Manually locking deadbolt**] [**or**] [**automatically locking spring bolt**].
2. Lock Type: Fee [**return/deposit**] [**collect/pay**].
3. Fee Type: [**Token**] [**Coin, one quarter**] [**Coin, two quarters**].
4. Coin Box: Manufacturer's standard housing or stainless steel cash box with stainless steel flanged cover set into base of lock channel frame. Furnish with removable cylinder and key, and master code changer key.

2.10 LOCKER BENCHES <**Insert designation**>

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Provide bench units with overall assembly height of [**17-1/2 inches (445 mm)**] <**Insert dimension**>.

C. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick)[**except provide 20- to 24-inch- (508- to 610-mm-) wide tops where accessible benches are indicated**].
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
3. Plastic laminate over particleboard core, with two steel tubes running full length of top and positioned to receive pedestal fasteners.

a. Color: [**Match metal lockers**] [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

4. Extruded aluminum with clear anodic finish.

D. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel:

a. 1-1/2-inch- (38-mm-) diameter steel tubing: threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.

1) Color: [**Match metal lockers**] [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

b. 1-1/4-inch- (32-mm-) diameter steel tubing: with 0.1265-inch- (3.2-mm-) thick steel flanges welded at top and base; with [**baked-enamel**] [**zinc-plated**] finish; anchored with exposed fasteners.

1) Color: [**Match metal lockers**] [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

E. Movable-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top, complete with fasteners, and as follows:

1. Aluminum: 1/8-inch-thick by 3-inch-wide (3-mm-thick by 76-mm-wide) channel or 1/4-inch-thick by 3-inch-wide (6-mm-thick by 76-mm-wide) bar stock, shaped into [**trapezoidal**] [**inverted-T**] form; with nonskid pads at bottom.

a. Finish: [**Clear**] [**Black**] [**Gold**] anodic finish.

2. Stainless Steel: 1/8-inch-thick by 3-inch-wide (3-mm-thick by 76-mm-wide) channel or 1/4-inch-thick by 3-inch-wide (6-mm-thick by 76-mm-wide) bar stock, shaped into trapezoidal form; with nonskid pads at bottom.

a. Finish: [**Manufacturer's standard**] [**No. 4B**].

F. Materials:

1. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
2. Plastic Laminate: NEMA LD 3, Grade HGP.
3. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
4. Steel Tube: ASTM A500/A500M, cold rolled.
5. <Double click to insert sustainable design text for composite wood products.>
6. Particleboard: ANSI A208.1, Grade M-2.

2.11 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
3. Triple-Tier Units: One double-prong ceiling hook.
4. Coat Rods: [**As indicated on Drawings**] [**For each compartment of each locker**] [**In lieu of ceiling hook for metal lockers 24 inches (610 mm) high or more**] [**In lieu of ceiling hook for metal lockers 18 inches (457 mm) deep or more**].
5. Open-Front Athletic Lockers: Two single-prong wall hooks bolted to locker back and coat rod.

D. Knocked-Down Construction: Fabricate metal lockers by [**assembling at Project site**] [**preassembling at plant prior to shipping**], using manufacturer's nuts, bolts, screws, or rivets.

E. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

F. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

G. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

H. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

I. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.

J. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.

K. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

L. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

M. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

N. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.12 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls[**, and elsewhere as indicated,**] for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top [**and bottom of lockers**] [**of lockers and to floor**].
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.

C. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

D. Equipment:

1. Attach hooks with at least two fasteners.

2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

E. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

F. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

G. Movable Benches: Place benches in locations indicated on Drawings.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.[**Verify that integral locking devices operate properly.**]

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 01 50 11

SECTION 10 11 13 13 - VISUAL DISPLAY SURFACES

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for visual display surfaces. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Chalkboards.
b. Markerboards.
c. Tackboards.
d. Visual display rails.
e. Visual display wall panels.
f. Support systems for visual display boards.
g. Sliding visual display units.
h. Visual display conference units.
i. Visual display wall coverings.
j. Electronic markerboards.

C. Definitions
1. Tackboard: Framed or unframed, tackable, visual display board assembly.
2. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.
3. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

D. Submittals
1. Product Data: For each type of product indicated.
a. Include rated capacities, operating characteristics, electrical characteristics and individual panel weights for sliding visual display units.
b. Include computer system requirements for electronic markerboards.
2. LEED Submittals:
a. Product Data for Credit EQ 4.4: For composite wood products, documentation indicating that the product contains no urea formaldehyde.
b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content and chemical components.
3. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
a. Show locations of panel joints.
b. Show locations of special-purpose graphics for visual display surfaces.
c. Include sections of typical trim members.
d. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each exposed product and for each color and texture specified.
5. Qualification Data: For qualified Installer.
6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.
7. Operation and Maintenance Data: For visual display surfaces and power-operated units to include in maintenance manuals.

8. Warranties: Sample of special warranties.

E. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to the Owner. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
2. Store visual display surfaces vertically with packing materials between each unit.

G. Project Conditions
1. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
   a. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

H. Warranty
1. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Surfaces lose original writing and erasing qualities.
      2) Surfaces exhibit crazing, cracking, or flaking.
   b. Warranty Period: 50 years from date of Final Completion **OR** Life of the building, **as directed**.
2. Special Warranty for Electronic Markerboards: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic markerboards that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Materials, General
1. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- (0.043-to-0.064-mm-) thick ground coat, and color cover coat; and with concealed face coated with primer and 1.7-to-2.5-mil- (0.043-to-0.064-mm-) thick ground coat.
   a. Matte-Finish Cover Coat: Low reflective; chalk wipes clean with dry cloth or standard eraser. Minimum 2.0-to-2.5-mil- (0.051-to-0.064-mm-) thick cover coat. Cover and ground

coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1250 deg F (677 deg C).

b. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil- (0.076-to-0.102-mm-) thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F (802 deg C).

2. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.024-inch (0.60-mm) uncoated thickness; with porcelain-enamel coating fused to steel at approximately 1000 deg F (538 deg C).
   a. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.
   b. Gloss Finish: Low gloss; dry-erase markers wipe clean with dry cloth or standard eraser. Suitable for use as projection screen.
3. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
   a. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.
   b. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
4. Melamine: Thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
5. High-Pressure Plastic Laminate: NEMA LD 3.
6. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
7. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.
8. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with surface-burning characteristics indicated.
9. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd. (508 g/sq. m); with surface-burning characteristics indicated.
10. Hardboard: ANSI A135.4, tempered.
11. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
12. Fiberboard: ASTM C 208.
13. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

B. Chalkboard Assemblies
1. Porcelain-Enamel Chalkboards: Balanced, high-pressure, factory-laminated chalkboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, **OR** 0.013-inch- (0.33-mm-) thick, **as directed**, porcelain-enamel face sheet with matte finish.
   a. Hardboard Core: 1/4 inch (6 mm) thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.0129-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
   b. Particleboard Core: 3/8 inch (9.5 mm) thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.0129-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
   c. Fiberboard Core: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick; with 0.001-inch- (0.025-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.0129-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
   d. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
   e. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
2. High-Pressure-Laminate Chalkboards: Balanced, high-pressure, factory-laminated chalkboard assembly of two-ply construction consisting of fiberboard core material and high-pressure-laminate writing surface.

3. Melamine Chalkboards: Fabricated from 1/4-inch- (6-mm-) thick, sealed and primed hardboard panels permanently bonded with melamine writing surface.
4. Painted-Finish Chalkboards: Fabricated from two plies of 1/4-inch- (6-mm-) thick, treated, tempered hardboard panels permanently surfaced with manufacturer's standard, heat-cured organic coating formulated for chalk-receptive matte finish.
5. Natural-Slate Chalkboards: Select grade, resurfaced, natural slate; free from ribbons and other natural marks that impair their functional use and durability as a writing surface.
   a. Writing surface shall be free of tooling marks, pits, chipping, scratches, and surface spalls in excess of those that can be easily corrected; and shall be free of surface-applied stain, dye, or other artificial coloring.
   b. Thickness: Not less than 1/4 inch (6 mm) or more than 3/8 inch (9.5 mm) thick with maximum deviation of 1/16 inch (1.6 mm) when an average thickness of at least 1/4 inch (6 mm) is maintained.

C. Markerboard Assemblies
1. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, **OR** 0.013-inch- (0.33-mm-) thick, **as directed**, porcelain-enamel face sheet with high-gloss **OR** low-gloss, **as directed**, finish.
   a. Hardboard Core: 1/4 inch (6 mm) thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
   b. Particleboard Core: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
   c. Fiberboard Core: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick; with 0.001-inch- (0.025-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
   d. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
   e. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
2. Melamine Markerboards: Fabricated from 1/4-inch- (6-mm-) thick, sealed and primed hardboard panels permanently bonded with melamine or another high-pressure-laminate writing surface.
3. High-Pressure-Laminate Markerboard Assembly: Balanced, high-pressure, factory-laminated chalkboard assembly of three-ply construction consisting of backing sheet, fiberboard core material, and high-pressure-laminate writing surface.

D. Tackboard Assemblies
1. Natural-Cork Tackboard:
   a. 1/16-inch- (1.6-mm-) thick, natural cork sheet factory laminated to 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-), **as directed**, thick fiberboard backing.
   b. 1/8-inch- (3-mm-) thick, natural cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
   c. 1/4-inch- (6-mm-) thick, natural cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.
2. Plastic-Impregnated-Cork Tackboard:
   a. 1/8-inch- (3-mm-) thick, plastic-impregnated cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
   b. 1/4-inch- (6-mm-) thick, plastic-impregnated cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.
3. Vinyl-Fabric-Faced Tackboard:
   a. Vinyl fabric factory laminated to 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-) **OR** 1/2-inch- (13-mm-), **as directed**, thick fiberboard backing.
   b. 1/16-inch- (1.6-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.

c. 1/8-inch- (3-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
d. 1/4-inch- (6-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.

4. Polyester-Fabric-Faced Tackboard:
a. Polyester fabric factory laminated to 3/8-inch- (9.5-mm-) **OR** 1/2-inch- (13-mm-), **as directed**, thick fiberboard backing.
b. 1/16-inch- (1.6-mm-) thick, polyester-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
c. 1/8-inch- (3-mm-) thick, polyester-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
d. 1/4-inch- (6-mm-) thick, polyester-fabric-faced cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.

E. Visual Display Rails
1. General: Manufacturer's standard, aluminum-framed, tackable cork **OR** fabric, **as directed**, visual display surface fabricated into narrow rail shape and designed for displaying material.

F. Visual Display Wall Panels
1. Marker Wall Sheets: Fabricated from 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets; for direct application to wall surface.
2. Marker Wall Panels: Fabricated from markerboard assembly indicated.
3. Tack Wall Panels: With tackable surface.
a. Fabricated from tackboard assembly indicated.
b. Natural Cork: 1/8-inch- (3-mm-) **OR** 1/4-inch- (6-mm-), **as directed**, thick, natural cork sheet for direct application to wall surface.
c. Plastic-Impregnated Cork: 1/8-inch- (3-mm-) **OR** 1/4-inch- (6-mm-), **as directed**, thick, plastic-impregnated cork sheet for direct application to wall surface.
d. Vinyl Fabric-Faced Cork: 1/4-inch- (6-mm-) thick, vinyl-fabric-faced cork sheet for direct application to wall surface.
e. Polyester-Fabric-Faced Cork: 1/4-inch- (6-mm-) thick, polyester-fabric-faced cork sheet for direct application to wall surface.
4. Joint Accessories: Manufacturer's standard, exposed trim **OR** concealed aluminum or steel spline, **as directed**, at butt joints.
5. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific tack wall panels and substrate application, as recommended in writing by visual display surface manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by visual display surface manufacturer for intended substrate.

G. Rail Support System For Visual Display Boards
1. Support Rails: Horizontal, wall-mounted, extruded-aluminum rails designed to receive hanger clip and to support visual display boards; capable of gripping and suspending paper directly from rail.
a. Finish: Clear anodic **OR** Color anodic **OR** Baked enamel **OR** Powder coat, **as directed**.
b. Color and Gloss: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
2. Hanger Clips: Extruded aluminum with finish to match rails; designed to support independent visual display boards by engaging support rail and top trim of board.
3. Visual Display Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage, and with aluminum trim designed to engage hanger clips.

H. Modular Support System For Visual Display Boards

1. Standards: 72-inch- (1829-mm-) long, extruded-aluminum slotted standards designed for supporting visual display boards on panel clips. Standards shall be punched at not less than 4 inches (100 mm) o.c.
   a. Finish: Clear anodic **OR** Color anodic **OR** Baked enamel **OR** Powder coat, **as directed**.
   b. Color and Gloss: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
2. Panel Clips: Extruded aluminum or steel with finish to match standards.

I. Sliding Visual Display Units
1. Horizontal-Sliding Visual Display Units: Factory-fabricated units consisting of extruded-aluminum tubular frame, fixed-rear visual display panel, aluminum-framed horizontal-sliding panels, and extruded-aluminum fascia that conceals overhead sliding track; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
   a. Two-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide two sliding panels, each equal to not less than one-half of overall length of unit.
   b. Three-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide three sliding panels, each equal to not less than one-third **OR** one-half, **as directed**, of overall length of unit.
   c. Four-Track Units: Fabricate unit with fixed rear panel centered in and covering not less than one-half of rear surface, and fixed front panel on each side of unit equal to not less than one-quarter of overall length of unit. Provide four sliding panels, each equal to not less than one-quarter of overall length of unit.
      1) Swinging Doors: Fabricated from same construction as sliding panels and supported on full-height continuous hinges. Provide visual display surface on both sides of each door.
   d. Sliding Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.
      1) Fabricate sliding panels with 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets.
   e. Hardware: Manufacturer's standard, extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.
2. Vertical-Sliding Visual Display Units: Factory-fabricated units consisting of extruded-aluminum tubular frame, fixed-rear visual display panel, and aluminum-framed vertical-sliding panels; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
   a. Type: Tubular frame on four sides **OR** top and two sides, with sides extending to floor; with kick panel to conceal sliding panels, **as directed**. Unit shall be designed to support panels independent of wall.
   b. Two-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide two sliding panels, each equal to not less than one-half of overall height of unit.
   c. Three-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide three sliding panels, each equal to not less than one-half of overall height of unit.
   d. Four-Track Units: Fabricate unit with fixed rear panel centered in and covering not less than one-half of rear surface. Provide four sliding panels, each equal to not less than one-half of overall height of unit.
   e. Sliding Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.
      1) Fabricate sliding panels with 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets.
   f. Hardware: Manufacturer's standard, neoprene ball-bearing end rollers, four on each side of each sliding panel. Counterbalance each sliding panel with lead counterweights supported by steel aircraft cable over ball-bearing sheaves; with removable cover plate for

access to counterweights. Provide rubber bumpers at top and bottom for each sliding panel.

g. Motorized Operation: Provide not less than one motor with gearhead reducers for each sliding panel, mounted above visual display unit and connected to sliding panels with steel aircraft cable. Provide removable cover plate for access to motor. Equip motors with limit switches to automatically stop motor at each end of travel.
   1) Electric Motors: UL approved or recognized, totally enclosed, complying with NEMA MG 1, with thermal-overload protection; 1/15 hp, single phase, 110 **OR** 220, **as directed**, V, 60 Hz.
   2) Control Station: Three-position, maintained-contact **OR** momentary-contact, **as directed**, switch-operated control station with open, close, and off functions; with NEMA ICS 6, Type 1 enclosure. Provide one control station for each sliding panel unit, unless directed otherwise.
   3) Key Switch: Provide supplementary key switch for each control station. Furnish two keys for each control station, keyed alike.

J. Visual Display Conference Units
1. Visual Display Conference Units: Factory-fabricated units consisting of hinged-door wood cabinet with perimeter face frame, sides, and back; not less than 3-inch (75-mm) interior depth and designed for surface wall mounting. Fabricate inside of cabinet and cabinet doors with fixed visual display surfaces.
   a. Wood Cabinets: Fabricated from solid wood with integral, solid-wood markertray. Fabricate hinged door panels with solid wood frame and wood-veneer exterior surface.
   b. Plastic-Laminate Cabinets: Cabinet and hinged door panels fabricated from manufacturer's standard, high-pressure, plastic-laminate-finished panels; with integral markertray.
   c. Hardware: Manufacturer's standard, full-height continuous hinges, wire door pulls, and door bumpers.
   d. Projection Screens: Manufacturer's standard, pull-down, matte, white projection screen, not less than 8 inches (200 mm) smaller in each direction than overall cabinet size, and mounted above rear visual display surface.
   e. Fluorescent Light: Manufacturer's standard, not less than 24 inches (610 mm) long, and mounted above rear visual display surface.

K. Visual Display Wall Coverings
1. Visual Display Wall Covering: Intended for use with dry-erase markers and as a projection surface, **as directed**, and consisting of low-gloss **OR** moderate-gloss **OR** high-gloss, **as directed**, plastic film bonded to fabric backing; not less than 0.012-mil (0.0003-mm) **OR** 0.020-mil (0.0005-mm), **as directed**, total thickness.
2. Surface Graphics: 2-inch- (50-mm-) square grid.
   a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
3. Magnetic Visual Display Wall Covering: Intended for use with dry-erase markers and magnetic aids and consisting of moderate-gloss plastic film bonded to ferrous-powdered fabric backing; not less than 0.025-mil (0.0006-mm) total thickness.
   a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
4. Adhesive: Mildew-resistant, nonstaining, strippable, **as directed**, adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall covering manufacturer for intended substrate.

L. Electronic Markerboards

1. General: Provide manufacturer's standard electronic markerboard that consists of touch-sensitive writing surface connected to microcomputer via RS-232 serial cable and that electronically records writing with standard dry-erase markers. Equip unit with cables, software, pens, erasers, mounting hardware, and accessories required for a complete installation.
2. Software: Capable of real-time recording, saving, and printing of everything that is written and drawn on electronic markerboard; with Windows **OR** Macintosh, **as directed**, operating system.
   a. File Export Formats: BMP, WMF, HTML, and vector-based formats.
   b. Compatibility: Compatible with Microsoft NetMeeting or other T.120-compliant software.
   c. Features: Capable of the following:
      1) Saving directly from screen.
      2) Erasing portions of screen.
      3) Printing directly from screen.
      4) Saving individual screens as separate pages.
      5) Showing onscreen toolbar **OR** keyboard, **as directed**.
      6) Recognizing not less than four pen colors.
      7) Recognizing finger touch control for presentations.
      8) Connecting multiple electronic markerboards to a single computer.
      9) Showing online help and tutorial.
3. Overall Size: Approximately 48 inches high by 60 inches wide (1219 mm high by 1524 mm wide).
4. Mounting: Wall mounted **OR** Supported by rail support system, **as directed**.

M. Chalkboard, Markerboard, And Tackboard Accessories
1. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape **OR** slim size and standard shape **OR** of size and shape indicated on Drawings, **as directed**.
   a. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints **OR** slip-on trim **OR** screw-on trim with Phillips flat-head screws, **as directed**.
   b. Factory-Applied Trim: Manufacturer's standard.
2. Factory-Applied Wood Trim: Red oak **OR** Walnut **OR** Manufacturer's standard species, **as directed**, not less than 1/2 inch (13 mm) thick; standard size and shape **OR** of size and shape indicated on Drawings, **as directed**.
3. Field-Applied Wood Trim: Comply with requirements specified in Division 06 Section(s) "Finish Carpentry" OR "Interior Architectural Woodwork" **as directed**.
4. Chalktray: Manufacturer's standard, continuous.
   a. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
   b. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
5. Map Rail: Provide the following accessories:
   a. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
   b. End Stops: Located at each end of map rail.
   c. Map Hooks: Two map hooks for every 48 inches (1219 mm) **OR** 1200 mm, **as directed**, of map rail or fraction thereof.
   d. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1219 mm) **OR** 1200 mm, **as directed**, of map rail or fraction thereof.
   e. Flag Holder: One for each room.
   f. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.
6. Special-Purpose Graphics: Fuse or paint the following graphics into surface of porcelain-enamel visual display unit:
   a. Semivisible writing guidelines.
   b. Penmanship lines.
   c. Music staff lines.
   d. Grid, 1 inch (25 mm) square.
   e. Graph coordinates, rectangular.

f. Horizontal lines, 2 inches (50 mm) o.c.
g. Polar coordinates.
h. USA map.
i. World map.
j. Soccer field.
k. Football field.
l. Basketball court.

N. Fabrication
1. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
2. Natural-Slate Chalkboards: Surface slate panels to a natural plane. Grind and hone to smooth, uniform finish equivalent to that obtained by minimum 180 grit and maximum 220 grit.
   a. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide continuous, uniform writing surface.
   b. Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches (75 mm) in either direction of equal spacing. Allow 1/4-inch (6-mm) clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
      1) Up to 5 feet (1.5 m); one panel.
      2) More than 5 feet (1.5 m) but less than 9 feet (2.7 m); two panels.
      3) More than 9 feet (2.7 m) but less than 13.5 feet (4.1 m); three panels.
      4) More than 13.5 feet (4.1 m) but less than 18 feet (5.5 m); four panels.
      5) More than 18 feet (5.5 m) but less than 22.5 feet (6.9 m); five panels.
      6) More than 22.5 feet (6.9 m) but less than 27 feet (8.2 m); six panels.
3. Visual Display Boards: Factory **OR** Field, **as directed**, assemble visual display boards unless otherwise indicated.
   a. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
4. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   a. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the Owner **OR** as indicated on approved Shop Drawings, **as directed**.
   b. Provide manufacturer's standard vertical-joint spline **OR** H-trim, **as directed**, system between abutting sections of chalkboards **OR** markerboards, **as directed**.
   c. Provide manufacturer's standard mullion trim at joints between chalkboards **OR** markerboards **OR** tackboards, **as directed**, of combination units.
   d. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by the Owner from manufacturer's standard structural support accessories to suit conditions indicated.
5. Modular Visual Display Boards: Fabricated with integral panel clips attached to core material.
6. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   a. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

O. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

P. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1.3 EXECUTION

A. Examination
1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
2. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.
3. Examine walls and partitions for proper preparation and backing for visual display surfaces.
4. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Comply with manufacturer's written instructions for surface preparation.
2. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
3. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
   a. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels **OR** visual display wall coverings, **as directed**, and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
   b. Prepare surfaces to receive visual display wall coverings and test for moisture according to requirements specified in Division 09 Section "Wall Coverings".
   OR
   Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
      1) Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
      2) Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
      3) Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
      4) Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
      5) Painted Surfaces: Treat areas susceptible to pigment bleeding.
4. Prepare recesses for sliding visual display units as required by type and size of unit.

C. Installation, General

1. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
   a. Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalktray.
   b. Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
   c. Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

   OR

   a. Mounting heights of 24 inches (610 mm) above finished floor to top of chalktray for kindergarten.
   b. Mounting heights of 26 inches (660 mm) above finished floor to top of chalktray for Grades 1 through 3.
   c. Mounting heights of 30 inches (762 mm) above finished floor to top of chalktray for Grades 4 through 6.
   d. Mounting heights of 34 inches (864 mm) above finished floor to top of chalktray for Grades 7 through 9.
   e. Mounting heights of 37 inches (940 mm) above finished floor to top of chalktray for Grades 10 and higher,

   as directed

D. Installation Of Field-Fabricated Visual Display Boards And Assemblies
1. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
   a. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the Owner **OR** as indicated on approved Shop Drawings, **as directed**.
   b. Provide manufacturer's standard vertical-joint spline **OR** H-trim, **as directed**, system between abutting sections of chalkboards **OR** markerboards, **as directed**.
   c. Provide manufacturer's standard mullion trim at joints between chalkboards **OR** markerboards **OR** tackboards, **as directed**, of combination units.
   d. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by the Owner from manufacturer's standard structural support accessories to suit conditions indicated.
2. Natural-Slate Chalkboards: Align and level joints between adjoining panels and apply manufacturer's recommended joint-filler compound. Hone and finish joints to continuous even plane.

E. Installation Of Factory-Fabricated Visual Display Boards And Assemblies
1. Visual Display Boards:
   a. Attach visual display boards to wall surfaces with egg-size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.

      OR

      Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
   b. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches (610 mm) o.c.
      1) Attach chalktrays to boards with fasteners at not more than 12 inches (300 mm) o.c.
   c. Field-Applied Wood Trim: Install trim according to requirements in Division 06 Section(s) "Finish Carpentry" OR "Interior Architectural Woodwork", **as directed**.

F. Installation Of Visual Display Rails
1. Display Rails: Install rails in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.
   a. Mounting Height: 48 inches (1219 mm) **OR** 60 inches (1524 mm), **as directed**, above finished floor to top of rail.

G. Installation Of Visual Display Wall Panels
1. Marker Wall Sheets: Attach wall sheets to wall surface with thin layer of adhesive over entire wall surface. Butt join adjacent panels and cover joint with matching joint strip installed with double-stick tape, **as directed**.
2. Marker Wall Panels: Attach panels to wall surface with egg-size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.
   a. Join adjacent wall panels with concealed steel splines for smooth alignment.
      OR
      Join adjacent wall panels with exposed, H-shaped aluminum trim painted to match wall panel.
3. Tack Wall Panels: Attach panels to wall surface with egg-size adhesive gobs at 16 inches (400 mm) o.c. horizontally and vertically.
   a. Install wrapped-edge wall panels with butt joints between adjacent wall panels.
   b. Join adjacent wall panels with exposed, H-shaped aluminum trim covered with same fabric as wall panels.

H. Installation Of Rail **OR** Modular, **as directed**, Support System
1. Rail Support System: Install horizontal support rail in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at 12 inches (300 mm) o.c.
   a. Mounting Height: 72 inches (1829 mm) above finished floor to top of rail.
   b. Hang visual display units on rail support system.
2. Modular Support System: Install adjustable standards in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Install standards at 48 inches (1219 mm) o.c., vertically aligned and plumb, and attached to wall surface with fasteners at 12 inches (300 mm) o.c.
   a. Mounting Height: 12 inches (300 mm) above finished floor to bottom of standard.
   b. Install single-slotted standard at each end of each run of standards and double-slotted standards at intermediate locations.
   c. Provide locking screw at top corner of visual display board at each standard.
   d. Hang visual display units on modular support system.

I. Installation Of Factory-Fabricated Visual Display Units
1. Sliding Visual Display Units: Install units in recessed locations and at mounting heights indicated. Attach to wall framing with fasteners at not more than 16 inches (400 mm) o.c.
   a. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
2. Visual Display Conference Units: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners through back of cabinet **OR** concealed brackets screwed to wall **OR** concealed wood cleats screwed to wall, **as directed**.
   a. Mounting Height: 72 inches (1829 mm) above finished floor to top of cabinet.

J. Installation Of Visual Display Wall Covering
1. General: Comply with visual display wall covering manufacturers' written installation instructions.
2. Install seams horizontal and level, with lowest seam 24 inches (610 mm) above finished floor. Railroad fabric (reverse roll direction) to ensure color matching.

3. Double cut seams, with no gaps or overlaps. Remove air bubbles, wrinkles, blisters, and other defects.
4. After installation, clean visual display wall covering according to manufacturer's written instructions. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

K. Installation Of Visual Electronic Markerboards
1. Electronic Markerboards: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall **OR** cubicle, **as directed**, surface with manufacturer's standard mounting hardware.
   a. Mounting Height: 72 inches (1829 mm) above finished floor to top of markerboard.

L. Cleaning And Protection
1. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
2. Touch up factory-applied finishes to restore damaged or soiled areas.
3. Cover and protect visual display surfaces after installation and cleaning.

M. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain motor-operated, sliding visual display units.

END OF SECTION 10 11 13 13

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Task	Specification	Specification Description
10 11 13 33	10 11 13 13	Visual Display Surfaces
10 11 16 13	10 11 13 13	Visual Display Surfaces
10 11 16 33	10 11 13 13	Visual Display Surfaces
10 11 23 13	10 11 13 13	Visual Display Surfaces
10 13 11 00	10 11 13 13	Visual Display Surfaces

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SECTION 10 14 00 00 - VITRIFIED BRICK PAVEMENT REPLACEMENT

1.1 GENERAL

A. General
1. Limits of Brick Pavement Replacement shall be as per the detail entitled “Payment Limits for Surface Restoration” shown in the plans, plus one foot on each side. Alternate individual bricks may have to be removed in order to maintain staggered joint pattern along the edge of the undisturbed brick pavement.

1.2 PRODUCT

A. Preparation
1. Base shall be provided and shaped to match level, kind and thickness (4” min.) of adjoining base. The base material shall be compacted to meet the density standards. 4” 2500 PSI concrete base may be used for irregular patches and where compaction is otherwise impractical. Concrete shall be properly placed, consolidated and cured. One inch of sand, or good grade dirt, free from clay, loam or other foreign matter shall be used for cushion to hold the bricks in place. The sand shall be shaped to a true surface parallel to required finished pavement surface.

B. Materials
1. Existing bricks shall be cleaned, stored, and secured by the Contractor.

1.3 EXECUTION

A. Reinstallation of Bricks
1. The bricks shall be installed in rows, better face upward, sorted by size with joints staggered, then rolled daily with a static tandem wheel roller. Additional bricks, if required, will be supplied by the Owner. City Personnel shall inspect work daily. After inspection, the bricks shall be sprayed with a solution of lime and water, using 26 lbs. of lime to 55 gallons of water. Asphalt steep 7330 or equal shall be used for joint filler. The steep shall be heated until fluid and poured over bricks and removed when cool with square pointed shovels dipped in lime water. Removed asphalt may be reused. If adjoining bricks are grouted, new filler shall be grout (8:1, builders sand: cement).

B. Acceptance
1. Upon completion of the work, and before acceptance and final payment, the Contractor shall remove all false work, equipment, rubbish, surplus, and discarded materials. The Contractor shall restore in an acceptable manner all property, both public and private, damaged during the prosecution of the work. The Contractor shall leave the roadway in a neat and presentable condition each day.

END OF SECTION 10 14 00 00

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Task	Specification	Specification Description
10 14 00 00	01 58 13 00	Signage
10 14 16 00	10 14 00 00	Vitrified Brick Pavement Replacement
10 14 16 00	01 58 13 00	Signage
10 14 19 00	01 22 16 00	No Specification Required
10 14 19 00	10 14 00 00	Vitrified Brick Pavement Replacement
10 14 19 00	01 58 13 00	Signage
10 14 23 00	10 14 00 00	Vitrified Brick Pavement Replacement
10 14 23 11	10 14 00 00	Vitrified Brick Pavement Replacement
10 14 23 11	01 58 13 00	Signage
10 14 53 00	10 14 00 00	Vitrified Brick Pavement Replacement

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SECTION 10 14 53 11 - TRAFFIC SIGNS

1.1 GENERAL

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

1.2 PRODUCT

A. Sign Foundations:
1. Replacement Foundation Footing Concrete shall be a mixture of cement complying with ASTM C 150 and aggregate complying with ASTM C 33. Compressive strength shall be 2,800 psi at 28 days.
2. Sulfur Mortar shall comply with ASTM C 287.
3. Reinforcing Steel shall comply with ASTM A 615.

B. Sign Supports shall be of the "break-away" type. Supports shall be strong enough to resist applicable wind forces without damage, but shall be designed to experience a brittle rupture type failure or a "quick separation" type joint.
1. Sign Support, Aluminum:
a. Replacement Castings shall be Alloy A356.0-T6 in compliance with ASTM B 108.
b. Replacement Structural Members shall comply with ASTM B 308.
c. Replacement Bars, Rods, Shapes, and Tubes shall comply with ASTM B 221, alloy 6061-T6.
d. Replacement Bolts, Nuts, and Screws shall match items being replaced and shall be alloy 2024-T4 with anodic coating complying with ASTM B 580, or 6061-T6 in compliance with ASTM B 211. Bolt heads shall be hexagon. Bolt threads shall be Class 2, 2A, or 2B in compliance with ANSI B18.2.1. Nuts shall be hexagon shaped in compliance with ANSI B18.2.2.
e. Replacement washers shall be furnished from sheet metal complying with ASTM B 209, alloy Alclad 2024-T3 or T4.
2. Sign Support, Steel:
a. Replacement Structural Members shall comply with ASTM A 36.
b. Replacement Bars shall comply with ASTM A 108.
c. Replacement Pipe shall comply with ASTM A 53 standard weight.
d. Replacement Fasteners shall comply with ASTM A 307 and ASTM A 325.
e. Replacement Anchor Bolts for anchoring base plates to concrete bases and nuts and washers shall be galvanized in compliance with ASTM A 153.
3. Sign Support, Wood:
a. Replacement Wood Sign Post shall be of the species listed in AASHTO M168, dressed four sides and having a pyramidal top cut before being treated.
b. Replacement Sign Post shall be pressure treated with creosote or creosote-tar solution complying with AWPB LP-55.

C. Sign Face:
1. Replacement Plywood Sign Face shall be grade HDOAB G-1 EXTERIOR, in compliance with DOC PS 1. Material shall be cut to size in compliance with ANSI D6.1E.
2. Replacement Galvanizing Steel Sign Face shall comply with USDOT FHA MUTCD.

D. Reflective Sheeting shall be enclosed lens unless otherwise directed by the Owner.

1. Enclosed Lens Reflective Sheeting shall comply with Fed. Spec. L-S-300.
2. Reflective Sheeting shall comply with FP-79 minimum reflective intensity. Measurements shall comply with Fed. Spec. L-S-300.
3. Color shall be matched visually and within the limits shown on the Color Tolerance Charts issued by the Federal Highway Administration. The diffuse day color of the reflective sheeting shall be determined in compliance with ASTM E 97.
4. Film:
   a. General: Reflective sheeting shall be sufficiently flexible to be easily cut to shape and permit application over, and conformance to, moderate shallow embossing characteristic of certain sign borders and symbols.
   b. Surface: Sheeting surface shall be smooth and flat, shall facilitate cleaning and wet performance, and shall exhibit 85 degrees glossmeter rating of not less than 40, as specified in ASTM D 523. The sheeting surface shall withstand cleaning with gasoline, VM&P Naphtha, mineral spirits, turpentine, methanol, and xylol.

E. Demountable Sign Face Materials:
1. Acrylic Plastic Reflectors: Replacement demountable sign letters, digits, arrows, borders, and alphabet accessories shall be reflectorized and shall consist of acrylic plastic reflectors supported by embossed aluminum frames. They shall comply with the Standard Alphabet for Highway Signs, of the Federal Highway Administration, Series E.
2. Design and Fabrication: The letters shall be modified as necessary to accommodate the required reflectors. All items except border strips shall be fabricated from 0.040-inch minimum sheet aluminum. Border strips shall be of 0.032-inch minimum sheet aluminum. Mounting holes shall be provided within the frames to permit the use of screws, rivets or other acceptable fasteners. The size and spacing of the reflector holes shall provide maximum night legibility and visibility of the finished cutout figure.
3. General Requirements: The reflectors shall be of acrylic plastic meeting the requirements of Fed. Spec. L-P-380, Type I, Class 3. The reflectors shall be yellow or colorless. The lens shall consist of a smooth front surface, free from projections or indentations other than for identification, and a rear surface bearing a prismatic configuration that will effect total internal reflection of light.
4. Reflective Sheeting:
   a. Demountable Sign Letters, Digits, Arrows, Borders, and Alphabet Accessories, when so specified, shall be reflectorized with reflective sheeting supported by flat aluminum backing and shall comply with the Standard Alphabet Highway Signs of the Federal Highway Administration.
   b. Design and Fabrication: Letter design shall be Series E, modified for legibility. All items except border strips shall be fabricated from 0.040-inch sheet aluminum, 6061-T6 alloy, with mounting holes to permit use of screws, rivets, or other acceptable fasteners.

F. Highway Delineators, Enclosed Lens Type: Replacement reflectors shall be of acrylic plastic and a minimum of 3 inches in diameter. They shall be mounted in a heavy-duty housing with a back plate. The reflector shall consist of a clear and transparent plastic lens, which shall be colorless, and a plastic back of the same material, fused to the lens under heat and pressure around the entire perimeter to form a homogeneous unit, permanently sealed against dust, water, and water vapor. The acrylic plastic shall comply with Fed. Spec. L-P-380, Type I, Class 3.

G. Highway Delineators, High Intensity Type:
1. Replacement Reflectorized Delineators shall consist of a reflective sheeting compound of glass spheres, embedded in a weatherproof, synthetic, noncellulose material. The overall size of the plastic reflectors shall be 4 inches by 5 inches, with a reflective area of at least 17.5 square inches.
2. Delineators shall be silver-white when viewed with reflected light.

H. Highway Delineators Including Posts and Attachments:

1. Reflective Sheeting: Replacement reflective sheeting for delineators shall match delineators being replaced.
2. Delineator Posts and Accessories shall be of steel or aluminum. They shall have the necessary holes for attachment of the delineator housing. The assembly shall be furnished with the necessary bolts, nuts, and washers for attaching to the posts.
3. Insulating Materials: Neoprene, for separation of aluminum and steel parts, shall contain at least 60 percent, by volume, of pure neoprene. Other material may be used, subject to the approval of the Owner as to pliability and ability to withstand wear caused by stretching or distortion.
4. Reflector Units for guardrail installation shall match existing reflector being replaced in size and color.
5. Highway Delineators shall be supplemented with directional guidance signs as directed by the Owner. Signs shall be the chevron alignment type and shall comply with ANSI D6.1E, Type W 1-8.

I. Painting Panels for Nonreflectorized Background:
1. Replacement Metal Panels for sign categories not required to be reflectorized shall have a nonreflectorized background composed of one spray coat of primer and two finish coats of baked enamel.
2. Finish Coats shall be baked alkyd resin enamels meeting Fed. Spec. TT-E-529, Class B, of a composition that affects the finished background surface. When thoroughly dry, the colors shall match those described in the current Highway Blue Color Tolerance Chart, PR Color No. 3, or in Highway Green Color Tolerance Chart, PR Color No. 4, of the Federal Highway Administration.
3. Wood Signs shall have two coats of oil paint complying with Fed. Spec. TT-P-52. Message paint shall be a single coat of oil paint. All colors shall comply with ANSI D6.1E.

J. Sign Wash Detergent shall comply with ASTM D 3399.

K. Street, Wayside, Utility Location, And Parking Lot Signs; Decals
1. Blanks: aluminum of type, size, and shape indicated.
2. Reflective sheeting: Type 1 sheeting having Level A reflective intensity.
3. Silk screen lettering paint and transparent process colors: as directed by the Owner.
4. Posts
   a. Drive type: as directed by the Owner.
   b. Pipe type: Two-inch inside diameter.
5. Hardware: as directed by the Owner.
6. Fabrication
   a. Dimensions, colors, and reflectorizing: As indicated, and in accordance with MUTCD.
   b. Size, style, and spacing of letters, numerals, symbols, and borders: As indicated, and the Owner; as supplemented by DOT/FHA's publication entitled Standard Highway Signs as specified in MUTCD 1978.
   c. Workmanship: as directed by the Owner.

1.3 EXECUTION

A. Footings for Signs, Posts, and Supports:
1. Backfill Material shall be at or near optimum moisture and neither dry nor saturated. It shall be tamped thoroughly in place.
2. Concrete Footings may be cast in place or precast. Hand mixing of concrete will be permitted where the quantity does not exceed one-half cubic yard.

B. Erection of Signs and Sign Supports: Sign posts shall be erected vertically. Posts erected in sleeves shall be anchored with sulphur mortar. Mortar shall comply with ASTM C 287. Sign faces shall be positioned to be generally perpendicular to the line-of-sight for the observer. Reflectorized signs shall

be inspected at night. If specular reflection is apparent on any sign, its position shall be adjusted by the Contractor to eliminate the condition.

C. Delineators and Hazard Markers: Delineator posts shall be driven to a depth of 30 inches.

D. Removal of Existing Signs and Posts:
   1. Damaged, Obsolete, or Change of Purpose Signs and Posts shall be removed and delivered to a storage area designated by the Owner. Post hole shall be backfilled, tamped, and made level with the adjacent surface. Disturbed paving, sidewalks, and grassed areas shall be replaced with matching material of same quality and quantity as existing.
   2. Signs and Posts to be Replaced shall be removed and replaced by new signs and posts in identical locations. Backfill around post shall be thoroughly compacted to hold posts securely in a vertical position.

E. Installation: Install in accordance with manufacturer's recommendations and as directed by the Owner. Unless otherwise indicated, install not more than one sign on each post.

END OF SECTION 10 14 53 11

SECTION 10 21 13 13 - TOILET COMPARTMENTS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for toilet compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Steel toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
b. Stainless-steel toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
c. Plastic-laminate-faced toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
d. Phenolic-core toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
e. Solid-polymer toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
b. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
4. Samples for each exposed product and for each color and texture specified.
5. Product certificates.
6. Maintenance data.

D. Quality Assurance
1. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete", **as directed**.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
b. Smoke-Developed Index: 450 or less.
3. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.2 PRODUCTS

A. Materials

1. Aluminum Castings: ASTM B 26/B 26M.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
3. Brass Castings: ASTM B 584.
4. Brass Extrusions: ASTM B 455.
5. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
   a. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z (03G).
   b. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvannealed.
6. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
7. Stainless-Steel Castings: ASTM A 743/A 743M.
8. Zamac: ASTM B 86, commercial zinc-alloy die castings.
9. Particleboard: ANSI A208.1, Grade M-2 with 45-lb (20.4-kg) density, made with binder containing no urea formaldehyde.
10. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.

B. Steel Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
3. Urinal-Screen Style: Wall hung, flat panel **OR** Wall hung with integral flanges **OR** Wall hung, wedge shaped **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
4. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Provide with no-sightline system, **as directed**. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
   a. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
   b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
   c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
5. Urinal-Screen Construction:
   a. Flat-Panel Urinal Screen: Matching panel construction.
   b. Integral-Flange, Wall-Hung Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
   c. Wedge-Shaped, Wall-Hung Urinal Screen: Similar to panels, V-shaped, fabricated for concealed wall attachment, and maximum 6 inches (152 mm) wide at wall and minimum 1 inch (25 mm) wide at protruding end.
6. Facing Sheets and Closures: Electrolytically coated steel **OR** Hot-dip galvanized-steel **OR** Electrolytically coated or hot-dip galvanized-steel, **as directed**, sheet with nominal base-metal (uncoated) thicknesses as follows:
   a. Pilasters, Braced at Both Ends (for overhead-braced and floor-and-ceiling-anchored mounting styles): Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
   b. Pilasters, Unbraced at One End (for floor-anchored and ceiling-hung mounting styles): Manufacturer's standard thickness, but not less than 0.048 inch (1.21 mm).
   c. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm) **OR** 0.036 inch (0.91 mm), **as directed**.
   d. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
   e. Flat-Panel Urinal Screens: Thickness matching the panels.

f. Integral-Flange, Wall-Hung Urinal Screens (for government-style metal screens): Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
g. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).

7. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
8. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap), **as directed**, matching that on the pilaster.
9. Brackets (Fittings):
   a. Stirrup Type: Ear or U-brackets; chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
   b. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel **OR** aluminum, **as directed**.
10. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking. Apply one color **OR** two colors, **as directed**, in each room.
    a. Color: As selected from manufacturer's full range.

C. Stainless-Steel Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
3. Urinal-Screen Style: Wall hung flat panel **OR** Wall hung with integral flanges **OR** Wall hung, wedge shaped **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
4. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Provide with no-sightline system, **as directed**. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
   a. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
   b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
   c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
5. Urinal-Screen Construction:
   a. Flat-Panel Urinal Screen: Matching panel construction.
   b. Integral-Flange, Wall-Hung Urinal Screen (for government-style metal screens): Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
   c. Wedge-Shaped, Wall-Hung Urinal Screen: Similar to panels, V-shaped, fabricated for concealed wall attachment, and maximum 6 inches (152 mm) wide at wall and minimum 1 inch (25 mm) wide at protruding end.
6. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses as follows:
   a. Pilasters, Braced at Both Ends (for overhead-braced and floor-and-ceiling-anchored mounting styles): Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
   b. Pilasters, Unbraced at One End (for floor-anchored and ceiling-hung mounting styles: Manufacturer's standard thickness, but not less than 0.050 inch (1.27 mm).
   c. Panels: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm) **OR** 0.038 inch (0.95 mm), **as directed**.

d. Doors: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
e. Flat-Panel Urinal Screens: Thickness matching the panels.
f. Integral-Flange, Wall-Hung Urinal Screens (for government-style metal screens: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
g. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).

7. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
8. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
9. Brackets (Fittings):
   a. Stirrup Type: Ear or U-brackets; chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
   b. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel **OR** aluminum, **as directed**.
10. Stainless-Steel Finish: No. 4 bright, directional polish **OR** Manufacturer's standard textured finish, **as directed**, on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

D. Plastic-Laminate-Faced Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
3. Urinal-Screen Style: Wall hung **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
4. Door, Panel, Screen, and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with laminate **OR** stainless-steel edge trim 0.050 inch (1.27 mm) thick, **as directed**, applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture. Provide with no-sightline system, **as directed**.
   a. Core Material: Particleboard.
   b. Doors and Panels: Finished to not less than 7/8 inch (22 mm) **OR** 1 inch (25 mm), **as directed**, thick.
   c. Pilasters: Provide construction to comply with one of the following, **as directed**:
      1) Finished to not less than 1-1/4 inches (32 mm) thick and with internal, nominal 0.134-inch- (3.42-mm-) thick, steel-sheet reinforcement, **as directed**.
      2) Finished to 1-1/4 inches (32 mm) thick and with manufacturer's standard steel-sheet core laminated to both sides of honeycomb of resin-impregnated kraft paper in lieu of particleboard core.
      3) Finished to not less than 1 inch (25 mm) thick and with internal, nominal 0.120-inch- (3.04-mm-) thick, steel-sheet reinforcement.
5. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
6. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish **OR** 1-1/4-inch- (32-mm-) square, stainless-steel tube 0.050 inch (1.27 mm) thick with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
7. Brackets (Fittings):
   a. Stirrup Type: Ear or U-brackets, chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.

b. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel **OR** aluminum, **as directed**.

8. Plastic-Laminate Finish: One color and pattern **OR** Two colors and patterns, **as directed**, in each room.
   a. Color and Pattern: As selected from manufacturer's full range.

E. Phenolic-Core Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
3. Urinal-Screen Style: Wall hung **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
4. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system, **as directed**. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.
5. Pilaster Shoes and Sleeves (Caps): Fabricated from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
6. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of monolithic phenolic urinal screen cut out at bottom to form a post **OR** material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
7. Brackets (Fittings):
   a. Stirrup Type: Ear or U-brackets, chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
   b. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel **OR** aluminum, **as directed**.
8. Phenolic-Panel Finish:
   a. Facing Sheet Finish: One color and pattern **OR** Two colors and patterns, **as directed**, in each room.
   b. Color and Pattern: As selected from manufacturer's full range, with manufacturer's standard dark color core **OR** through-color core matching face sheet, **as directed**.

F. Solid-Polymer Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
3. Urinal-Screen Style: Wall hung **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
4. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) **OR** polypropylene (PP), **as directed**, panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, **as directed**, and with homogenous color and pattern throughout thickness of material.
   a. Integral Hinges: Configure doors and pilasters to receive integral hinges.
   b. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum **OR** stainless-steel, **as directed**, strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
   c. Color and Pattern: One color and pattern **OR** Two colors and patterns, **as directed**, in each room as indicated by manufacturer's designations **OR** as selected from manufacturer's full range, **as directed**.
5. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer **OR** stainless steel, **as directed**.

a. Polymer Color and Pattern: Matching pilaster **OR** Contrasting with pilaster, as indicated by manufacturer's designations **OR** Contrasting with pilaster, as selected from manufacturer's full range, **as directed**.

6. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
7. Brackets (Fittings):
   a. Stirrup Type: Ear or U-brackets, chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
   b. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or extruded aluminum **OR** polymer **OR** extruded aluminum **OR** stainless steel, **as directed**.
      1) Polymer Color and Pattern: Matching panel **OR** Contrasting with panel, as indicated by manufacturer's designations **OR** Contrasting with panel, as selected from manufacturer's full range, **as directed**.
8. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid polymer.

G. Accessories
1. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   a. Material: Chrome-plated zamac **OR** Clear-anodized aluminum **OR** Stainless steel **OR** Chrome-plated brass, **as directed**.
   b. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees **OR** continuous, cam type that swings to a closed or partially open position **OR** continuous, spring-loaded type **OR** integral hinge for solid-polymer doors, **as directed**.
   c. Latch and Keeper: Manufacturer's standard recessed **OR** surface-mounted, **as directed**, latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
   d. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
   e. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors, **as directed**.
   f. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
2. Overhead Bracing (for overhead-braced units): Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
3. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

H. Fabrication
1. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
2. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
3. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished

ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

4. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
5. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms, **as directed**, of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
6. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

1.3 EXECUTION

A. Installation

1. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   a. Maximum Clearances:
      1) Pilasters and Panels: 1/2 inch (13 mm).
      2) Panels and Walls: 1 inch (25 mm).
   b. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached **OR** three brackets attached at midpoint and, **as directed**, near top and bottom of panel.
      1) Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      2) Align brackets at pilasters with brackets at walls.
2. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
3. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
4. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
5. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
6. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

B. Adjusting

1. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 10 21 13 13

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Task	Specification	Specification Description
10 21 13 13	01 22 16 00	No Specification Required
10 21 13 14	01 22 16 00	No Specification Required
10 21 13 14	10 21 13 13	Toilet Compartments
10 21 13 16	01 22 16 00	No Specification Required
10 21 13 16	10 21 13 13	Toilet Compartments

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SECTION 10 21 13 19 - SOLID SURFACE MATERIAL TOILET COMPARTMENTS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for solid surface material toilet compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals
1. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
2. Samples:
   a. Panel: 1'-0" by 1'-0" panel showing construction with two sides and two edges, including one finished corner condition.
   b. Hardware: Actual hardware item
3. Manufacturer's installation and maintenance instructions.

C. Warranty
1. Special Warranty: Solid surface material compartment manufacturer's three year warranty against defects in fabricated products. Provide for product replacement only; labor not included. Damage caused by physical or chemical abuse is not warrantied.

1.2 PRODUCTS

A. Manufactured Units
1. Product standard of quality: E.I. DuPont de Nemours and Company, Inc.; Privacy Partitions.

B. Types:
1. Floor supported, overhead braced compartments.
2. Wall hung urinal screens.

C. Materials:
1. Partitions, panels, headrails, and doors:
   a. Material: E.I. DuPont de Nemours and Company, Inc.; Corian, or approved equivalent.
   b. Characteristics:
      1) Material type: Homogeneous filled methyl methacrylate sheet, not coated.
      2) Meet ANSI Zl24.3 and 6, Type Six.
      3) Thickness: 1/2".
         a) Partition panels and doors: 1/2".
         b) Urinal screen panels: 1/2".
   c. Colors: Selected from manufacturer's color selection.
   d. Finish: Matte.
2. Pilasters, hardware, and fittings: Note requirements in FABRICATION Article for hardware concealment.
   a. Pilaster material: Same material as panels; 1" thickness.
   b. Acceptable hardware manufacturer: Jack Knob Hardware, or approved equivalent.
   c. Hinges:
      1) ANSI Type 304 stainless steel; surface mounted; self closing pivot hinge type, two per door; matt finish.
      2) Type: Adjustable to return door by gravity to preset position when not latched.
   d. Wall brackets:

1) Material: ASTM B209-90, extruded aluminum alloy 6463-T5, mill finish, full length continuous wall brackets; extrusion weighing not less than 1.685 lbs. per LF.
2) Predrill by manufacturer; holes spaced 6" along full bracket length; tamper resistant bolt attachment.

e. Pilaster hanger:
1) Manufacturer's standard galvanized anchorage device for attachment of pilaster to structural support and for leveling compartment.
2) Hanger consists of threaded rods, saddle, lock washers, and leveling nuts.
3) Design pilaster hangers to transmit loads to above-ceiling support system, not finished ceiling.

f. Pilaster base:
1) Type: Manufacturer's standard galvanized anchorage devices for attachment of pilaster to supporting floor and for leveling of compartment. Base consists of threaded rods, saddle, lock washers, leveling nuts, and minimum of two brass or lead expansion shields per base.
2) Anchor penetration: Penetrate floor at least 1” for overhead braced compartments.

g. Latch and keeper: AISI Type 304 Type stainless steel; 360 deg. pivot on latch; ADA compatible; surface mounted.
h. Door stop/bumper: AISI Type 304 Type stainless steel; surface mounted.
i. Door pull: Same material as panels; meet ADA requirements on handicap stalls.
j. Coat hook; one per unit: Same material as panels; surface mounted.
k. Grab bar mounting plate: Same material as panels; recessed back; complete with "T" nuts and screws; one per each mounting location to divider panel.
l. Headrail for overhead braced units: ASTM B209-90, 6063-T6 extruded aluminum, satin anodized finish.

D. Accessories:
1. Exposed fasteners: Stainless steel or chrome plated brass with theft resistant one-way heads,
2. Unexposed fasteners: Galvanized steel, hot-dip coated following fabrication.
3. Inserts for door hardware, hinges, latches, and coat hooks: Threaded steel.
4. Adhesives: Type recommended by panel material manufacturer for joints.
5. Silicone sealant: Specified in Joints Sealants Section.

E. Fabrication
1. Shop assembly:
a. Fabricate components in accord with manufacturers standards, without face or edge seams in solid plastic material; bevel exposed edges.
b. Factory install metal inserts into components for screw fastened hardware; fasteners secured directly into core are prohibited.
c. Pre-notch and predrill panels for hardware at factory. Exposed hardware in completed installation includes only the following items or portion of items:
1) Door hinge barrel.
2) Door latch and keeper.
3) Door striker.
d. Cover hardware with 1/2" solid surfacing material strips, except as indicated above.
e. Secure templates and factory cut panels for installation of accessories furnished under other Sections.
f. Doors: Inswing and outswing type indicated.
g. Exposed surfaces free from marks and blemishes; completely hide through material joints.
2. Tolerances; variation in size: ±1/8"

1.3 EXECUTION

A. Installation

1. General:
   a. Erect solid surface material compartment system plumb; attach to supporting structure indicated on reviewed shop drawings.
   b. Attach solid surface material compartment system to back-up construction; use fasteners indicated on reviewed shop drawings.
   c. Secure solid surface material panels to walls with continuous mounting flanges.
   d. Locate wall brackets aligning holes for fasteners with masonry or tile joints.
   e. Floor supported, overhead braced compartments:
      1) Attach pilasters to supporting floor with pilaster base indicated on reviewed shop drawings.
      2) Level and plumb compartments. Tighten pilaster base fasteners.
      3) Secure pilaster shoes in position against finished floor.
      4) Secure headrail to panels with minimum of two fasteners per face. Provide cover plates for exposed ends.
      5) Set door tops parallel with headrail when doors are in closed position.
   f. Wall hung screens:
      1) Attach screens to wall construction with brackets and fasteners, indicated on reviewed shop drawings.
      2) Position and level units. Tighten fasteners in place.

B. Application
   1. Tolerances:
      a. Between panel and pilaster: 1/2", except where concealed fasteners are used.
      b. Between door edge and pilaster: 1/4"
      c. Between panel and wall: 1".
   2. Conceal evidence of drilling, cutting, and fitting to room finishes.

C. Adjustment And Cleaning
   1. Adjustment:
      a. Lubricate and adjust hardware. Tighten fasteners.
      b. Set hinges on in-swing doors to hold doors open approximately 15 deg. from closed position when unlatched.
      c. Set hinges on out-swing doors to return to closed position.
   2. Cleaning:
      a. Remove protective coverings from compartments and hardware.
      b. Clean exposed surfaces of compartments and hardware using materials and methods recommended by solid surface material compartment system manufacturer.

END OF SECTION 10 21 13 19

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Task	Specification	Specification Description
10 21 13 19	10 21 13 13	Toilet Compartments
10 21 13 43	01 22 16 00	No Specification Required
10 21 13 43	10 21 13 13	Toilet Compartments

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SECTION 10 21 16 17 - SHOWER AND DRESSING COMPARTMENTS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for shower and dressing compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Shower compartments fabricated from steel, stainless steel, solid phenolic, or solid polymer.
b. Dressing compartments fabricated from steel, stainless steel, solid phenolic, solid polymer, or plastic laminate.
c. Shower receptors.

C. Submittals
1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. LEED Submittals:
a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
b. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: For shower and dressing compartments. Include plans, elevations, sections, details, and attachments to other work.
a. Show locations of cutouts for compartment-mounted accessories.
b. Show locations of reinforcements for compartment-mounted grab bars.
c. Show locations of centerlines of drains.
d. Show ceiling grid and overhead support or bracing locations.
4. Samples: For the following products, in manufacturer's standard sizes unless otherwise indicated:
a. Each type of material, color, and finish required for compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for the Work.
b. Each type of hardware and accessory.
c. Curtain Fabric: 12-inch- (305-mm-) square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
5. Product Certificates: For each type of shower and dressing compartment, from manufacturer.
6. Maintenance Data: For shower and dressing compartments to include in maintenance manuals.

D. Quality Assurance
1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
b. Smoke-Developed Index: 450 or less.
2. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 for shower and dressing compartments designated as accessible.

E. Project Conditions
1. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with shower and dressing compartments by field measurements before fabrication.

1.2 PRODUCTS

A. Materials
1. Aluminum Castings: ASTM B 26/B 26M.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
3. Brass Castings: ASTM B 584.
4. Brass Extrusions: ASTM B 455.
5. Steel Sheet: ASTM A 653/A 653M, either hot-dip galvanized or galvannealed; mill phosphatized and selected for smoothness.
6. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
7. Stainless-Steel Castings: ASTM A 743/A 743M.
8. Particleboard: ANSI A208.1, Grade M-2 with 45-lb (20.4-kg) density, made with binder containing no urea formaldehyde.
9. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.

B. Steel Compartments
1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Seamless metal facing sheets, pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures and with corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
   a. Core Material: Manufacturer's standard, sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for panels and 1-1/4 inches (32 mm) for pilasters.
   b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on compartments.
   c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to compartments.
4. Door Construction: Match panels; 1-inch (25-mm) finished thickness.
5. Facing Sheets and Closures: Hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:
   a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
   b. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm) **OR** 0.036 inch (0.91 mm), **as directed**.
   c. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
6. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
7. Brackets (Fittings):
   a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
   b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
   c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".
8. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply

with coating manufacturer's written instructions for applying and baking. Apply one color **OR** two colors, **as directed**, in each room.

a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** Match steel toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.

C. Stainless-Steel Compartments

1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Seamless metal facing sheets, pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures and with corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
   a. Core Material: Manufacturer's standard, sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for panels and 1-1/4 inches (32 mm) for pilasters.
   b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on compartments.
   c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to compartments.
4. Door Construction: Match panels; 1-inch (25-mm) finished thickness.
5. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses as follows:
   a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
   b. Panels: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm) **OR** 0.038 inch (0.95 mm), **as directed**.
6. Doors: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
7. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
8. Brackets (Fittings):
   a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
   b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
   c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".
9. Stainless-Steel Finish: No. 4, bright, directional polish **OR** Manufacturer's standard textured finish **OR** Match stainless-steel toilet-compartment finish, specified in Division 10 Section "Toilet Compartments", **as directed**, on exposed faces. Protect exposed surfaces from damage by applying strippable, temporary protective covering before shipment.

D. Phenolic-Core Compartments

1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Solid phenolic material consisting of solid phenolic-core panel with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated) and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick pilasters and minimum 1/2-inch- (13-mm-) thick panels.
4. Door Construction: Match panels; 3/4-inch (19-mm) minimum thickness.
5. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
6. Brackets (Fittings):
   a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.

b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".

7. Phenolic-Core-Panel Finish:
a. Facing Sheet Finish: One color and pattern **OR** Two colors and patterns, **as directed**, in each room.
b. Color and Pattern: As indicated by manufacturer's designations, **OR** As selected from manufacturer's full range, **OR** Match phenolic-core toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**, with manufacturer's standard dark-color core **OR** through-color core matching face sheet, **as directed**.

E. Solid-Polymer Compartments
1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Solid HDPE panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.
a. Integral Hinges: Configure doors and pilasters to receive integral hinges.
b. Heat-Sink Strip: Manufacturer's standard, continuous, clear-anodized extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
c. Color and Pattern: One color and pattern **OR** Two colors and patterns, **as directed**, in each room; as indicated by manufacturer's designations **OR** as selected from manufacturer's full range **OR** match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
4. Door Construction: Match panels.
5. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.
a. Polymer Color and Pattern: Match pilaster **OR** Contrast with pilaster, as indicated by manufacturer's designations **OR** Contrast with pilaster, as selected from manufacturer's full range **OR** Match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
6. Brackets (Fittings):
a. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or clear-anodized extruded aluminum **OR** polymer **OR** clear-anodized extruded aluminum, **as directed**.
1) Polymer Color and Pattern: Match panel **OR** Contrast with panel, as indicated by manufacturer's designations **OR** Contrast with panel, as selected from manufacturer's full range **OR** Match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".

F. Plastic-Laminate-Faced Dressing Compartments
1. Configuration: Dressing compartment attached to steel **OR** stainless-steel **OR** phenolic-core **OR** solid-polymer, **as directed**, shower compartment as shown on Drawings.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with laminate **OR** stainless-steel edge trim 0.050 inch (1.27 mm) thick, **as directed**, applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.
a. Core Material: Particleboard.

b. Panels: Finished to not less than 1 inch (25 mm) thick.
c. Pilasters: Comply with one of the following:
1) Finished to not less than 1-1/4 inches (32 mm) thick and with internal, nominal 0.134-inch- (3.42-mm-) thick, steel-sheet reinforcement.
OR
Finished to not less than 1 inch (25 mm) thick and with internal, nominal 0.120-inch- (3.04-mm-) thick, steel-sheet reinforcement.

4. Door Construction: Match panels.
5. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
6. Brackets (Fittings):
a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
7. Plastic-Laminate Finish: One color and pattern **OR** Two colors and patterns, **as directed**, in each room.
a. Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** Match toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.

G. Shower Receptors
1. General: Manufacturer's standard, prefabricated, terrazzo receptor complete with integral drain.
a. Curb: Not less than 2 inches (51 mm) and not more than 9 inches (229 mm) deep when measured from the top of the curb to the top of the drain; with curb threshold not less than 1 inch (25 mm) below the sides and back of the receptor; and with a ramped entrance surface for accessible compartments, **as directed**.
b. Floor: Finished, sloping uniformly toward the drain and not less than 1/4 unit vertical in 12 units horizontal and not more than 1/2 inch (13 mm).
c. Drain Strainer: Manufacturer's standard, removable brass strainer **OR** chrome strainer **OR** stainless-steel strainer **OR** plastic strainer, matching the receptor, **as directed**.
d. Drain Gasket: Manufacturer's standard gasket sized to fit waste pipe.
e. Waterstop: Manufacturer's standard, continuous galvanized-steel flange or rabbeted groove to receive panels and create a waterstop when panels are in place.
2. Finish: Manufacturer's standard finish on exposed surfaces, matching the enclosure panels **OR** contrasting with the enclosure panels, as indicated by manufacturer's designations **OR** contrasting with the enclosure panels, as selected from manufacturer's full range, **as directed**, and with slip-resistant floor surface texture.

H. Accessories
1. Door Hardware and Accessories: Manufacturer's standard design, heavy-duty, operating hardware and accessories.
a. Material: Clear-anodized aluminum **OR** Stainless steel **OR** Chrome-plated brass, **as directed**.
b. Hinges: Manufacturer's standard, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees **OR** continuous, cam type that swings to a closed or partially open position **OR** continuous, spring-loaded type **OR** integral hinge for solid-polymer doors, **as directed**.
c. Latch and Keeper: Manufacturer's standard, recessed **OR** surface-mounted, **as directed**, latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at each compartment, accessible or not **OR** at compartments designated as accessible, **as directed**.
d. Clothing Hooks: Manufacturer's standard clothing hooks in each dressing compartment; include one combination hook and rubber-tipped bumper at in-swinging doors, sized to prevent door from hitting wall panel or compartment-mounted accessories, **as directed**.

e. Door Bumper: Manufacturer's standard, rubber-tipped bumper at out-swinging doors.
f. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

2. Overhead Bracing: Manufacturer's standard, continuous, extruded-aluminum head rail or cap with antigrip profile; in manufacturer's standard finish.
3. Head Rail with Hooks: Manufacturer's standard, continuous, extruded-aluminum head rail or cap with curtain hooks running in concealed track; with antigrip profile; in manufacturer's standard finish.
OR
Curtain Rod with Hooks: Manufacturer's standard, 1-inch- (25-mm-) diameter, stainless-steel curtain rod with matching hooks.
4. Curtain: Flame-resistant, polyester-reinforced vinyl fabric **OR** manufacturer's standard fabric, **as directed**, that is stain resistant, self-sanitizing, antistatic, and antimicrobial; launderable to a temperature of not less than 90 deg F (32 deg C).
a. Flame Resistance: Passes NFPA 701 tests when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
b. Labeling: Identify fabrics with appropriate markings of applicable testing and inspecting agency.
c. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152 mm) o.c.; machined into top hem.
d. Length: Where curtain extends to a floor surface, size so that bottom hem clears finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) above floor surface. Where curtains extend to a shower-receptor curb, size so that bottom hem hangs above curb line and clears curb line by not more than 1/2 inch (13 mm).
e. Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Soap Holder: Surface-mounted **OR** Recessed, **as directed**, seamless stainless-steel soap dish.
6. Seats: Manufacturer's standard, panel-mounted, wall-mounted or floor-mounted benches.
a. Material: Wood **OR** Solid phenolic **OR** Molded plastic **OR** Stainless steel, **as directed**.
b. Operation: Fixed **OR** Folding, **as directed**.
c. Finish: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** Match enclosure panels, **as directed**.
7. Anchorages and Fasteners: Manufacturer's standard, exposed fasteners of stainless steel, chrome-plated steel, or solid brass, finished to match the items they are securing; with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

I. Fabrication
1. Overhead-Braced Compartments: Provide manufacturer's standard, corrosion-resistant supports, leveling method, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling method.
2. Floor-and-Ceiling-Anchored Compartments: Provide manufacturer's standard, corrosion-resistant anchoring assemblies at pilasters and walls with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
3. Door Sizes and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard shower and dressing compartments, and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

1.3 EXECUTION

A. Installation

1. General: Comply with manufacturer's written installation instructions. Install compartments rigid, straight, level, and plumb. Secure compartments in position with manufacturer's recommended anchoring devices.
   a. Maximum Clearances for Dressing Compartment:
      1) Pilasters and Panels: 1/2 inch (13 mm).
      2) Panels and Walls: 1 inch (25 mm).
   b. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached **OR** three brackets attached at midpoint and, **as directed**, near top and bottom of panel.
      1) Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      2) Align brackets at pilasters with brackets at walls.
2. Overhead-Braced Compartments: Secure pilasters to floor, and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position, **as directed**.
3. Floor-and-Ceiling-Anchored Compartments: Secure pilasters to supporting construction, and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position, **as directed**.
4. Curtains: Install curtains to specified length and verify that they hang vertically without stress points or diagonal folds.
5. Shower Receptors: Install prefabricated shower receptors with drain gasket compression fit to outside diameter of waste pipe.

B. Adjusting
1. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.
2. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 16 17

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SECTION 10 21 16 17a - CUBICLE CURTAINS AND TRACKS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for cubicle curtains and tracks. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Curtain tracks and curtain carriers.
b. IV tracks and hangers.
c. Cubicle, dressing area, tub, and shower curtains.

C. Definition
1. IV: Intravenous.

D. Performance Requirements
1. Curtains: Provide curtain fabrics with the following characteristics:
a. Fabrics are launderable to a temperature of not less than 160 deg F (71 deg C) **OR** 90 deg F (32 deg C), **as directed**.
b. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
1) Identify fabrics with appropriate markings of applicable testing and inspecting agency.

E. Submittals
1. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
a. Include data on each type of applied curtain treatment.
2. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
a. Include details on blocking above ceiling and in walls.
3. Samples: For each type of product required.
4. Curtain and Track Schedule: Use same designations indicated on Drawings.
5. Operation and Maintenance Data.

1.2 PRODUCTS

A. Curtain Tracks
1. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high) **OR** 5/8 inch wide by 1/2 inch high (16 mm wide by 13 mm high), **as directed**; with minimum wall thickness of 0.050 inch (1.27 mm) **OR** 0.058 inch (1.47 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
a. Curved Track: Factory-fabricated, 12-inch- (305-mm-) **OR** 14-inch- (356-mm-) **OR** 18-inch- (457-mm-), **as directed**, radius bends.
b. Finish: Clear anodized **OR** Satin anodized **OR** Baked enamel, acrylic, or epoxy, **as directed**.
2. PVC Track: Not less than 1-1/4 inches wide by 15/16 inch high (32 mm wide by 24 mm high).
a. Curved Track: Factory-fabricated, 12-inch- (305-mm-) radius bends.

3. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
   a. Suspended Track Support: Not less than 5/8-inch- (16-mm-) square **OR** 7/8-inch- (22.2-mm-) OD, **as directed**, tube.
   b. End Stop: Nonremovable **OR** Removable with carrier hook, **as directed**.
   c. Switch Unit: Shuttle and coupling device for rerouting and securing cubicle curtain, with pull chain for switching track.
   d. Hinged Loading Unit: Detachable hinge and lock unit factory assembled on 60-inch (1524-mm) section of manufacturer's extruded-aluminum track. Provide 1 operating wand for every 10 cubicles.
4. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel **OR** nylon **OR** aluminum, **as directed**, hook.
5. Curtain Carriers: One-piece nylon glide with chrome-plated steel **OR** nylon, **as directed**, hook.
6. Breakaway Curtain Carriers: One-piece nylon **OR** Velcro, **as directed**, breakaway curtain carriers designed to allow curtains to detach from tracks with a pulling force of no more than 5 lbf (22.2 N).
7. Exposed Fasteners: Stainless steel.
8. Concealed Fasteners: Hot-dip galvanized **OR** Stainless steel, **as directed**.

B. IV Support Systems
1. Extruded-Aluminum IV Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high); with minimum wall thickness of 0.058 inch (1.47 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
   a. Curved Track: Factory fabricated 12-inch- (305-mm-) **OR** 14-inch- (356-mm-) **OR** 18-inch- (457-mm-), **as directed**, radius bends.
   b. Finish: Clear anodized **OR** Satin anodized **OR** Baked enamel, acrylic, or epoxy, **as directed**.
2. IV Carriers: Four nylon rollers and nylon **OR** steel or stainless-steel, **as directed**, axles, with ball bearings, **as directed**, with hanger loop fabricated from 1/4-inch- (6-mm-) diameter stainless steel.
3. Stationary IV Hangers: 24-inch (610-mm) **OR** 30-inch (762-mm) **OR** 36-inch (914-mm) **OR** 42-inch (1067-mm) **OR** 48-inch (1219-mm), **as directed**, overall height with stainless-steel shaft; with 4 **OR** 8, **as directed**, folding **OR** nonfolding, **as directed**, 1/4-inch (6-mm) stainless-steel arms with loops, a stainless-steel bottom loop, and a stainless-steel top loop to attach to carrier.
   a. Top Loop: Coated for nonconductivity **OR** Uncoated, **as directed**.
4. Telescoping IV Hangers: 28-inch (711-mm) **OR** 39-inch (991-mm) **OR** 45-inch (1143-mm) **OR** 51-inch (1295-mm) **OR** 57-inch (1448-mm), **as directed**, overall height with a 3/4-inch (19-mm) stainless-steel main shaft and a 3/8-inch (9.5-mm) stainless-steel inner shaft, minimum vertical adjustment of 16 inches (406 mm); with 4 **OR** 8, **as directed**, folding **OR** nonfolding, **as directed**, 1/4-inch (6-mm) stainless-steel arms with loops and a stainless-steel top loop to attach to carrier.
   a. Top Loop: Coated for nonconductivity **OR** Uncoated, **as directed**.
   b. Adjustment Control: Push button **OR** Release ring, **as directed**.

C. Curtains
1. Cubicle Curtain and Dressing Area Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.
   a. Pattern: **<Insert manufacturer's style name.>**
   b. Color: As selected from manufacturer's full range.
2. Shower and Tub Curtain Fabric: Curtain manufacturer's standard. Polyester-reinforced vinyl fabric; flame resistant, stain resistant, and antimicrobial.
   a. Pattern: **<Insert manufacturer's style name.>**
   b. Color: As selected from manufacturer's full range.
3. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152 mm) o.c.; machined into top hem.

4. Mesh Top: No. 50 **OR** 40 **OR** 42, **as directed**, nylon mesh.
5. Beaded-Chain Curtain Drop: 6 inches (152 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm), **as directed**, long; nickel-plated steel, with aluminum hook.
6. PVC-Strip Curtain Drop: 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**, long, with chrome-plated steel hook.
   a. Curtain Movers: In-line hinged nylon spacers that connect to the top of PVC-strip curtain drops to provide tangle-free operation.
7. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

D. Curtain Fabrication
1. Fabricate curtains to comply with the following requirements:
   a. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches (305 mm) added fullness.
   b. Length: Equal to floor-to-ceiling height minus depth of track and carrier at top, and minus distance above the finished floor at bottom as follows:
      OR
      Length: Equal to floor-to-ceiling height, with 20-inch (508-mm) mesh top, and minus distance above the finished floor at bottom as follows:
      OR
      Length: Equal to floor-to-ceiling height minus 18 inches (457 mm) from finished ceiling at top, and minus distance above the finished floor at bottom as follows:
      1) Cubicle Curtains: 12 inches (305 mm) **OR** 15 inches (381 mm), **as directed**.
      2) Dressing Area Curtains: 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
      3) Tub Curtains: 6 inches (152 mm).
      4) Shower Curtains: 1/2 inch (13 mm).
   c. Top Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lock stitched.
   d. Mesh Top: Top hem not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch (13-mm) triple thickness, top hem of curtain fabric.
   e. Bottom Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, double thickness and single **OR** double thickness and double **OR** triple thickness, reinforced, and double, **as directed**, lock stitched.
   f. Side Hems: Not less than 1/2 inch (13 mm) and not more than 1-1/4 inches (32 mm) wide, with double **OR** triple, **as directed**, turned edges, and single lock stitched.
2. Vertical Seams: Not less than 1/2 inch (13 mm) wide, double turned and double stitched.

1.3 EXECUTION

A. Installation
1. General: Install tracks level and plumb, according to manufacturer's written instructions.
2. Up to 16 feet (4.9 m) **OR** 20 feet (6.0 m), **as directed**, in length, provide track fabricated from 1 continuous length.
   a. Curtain Track Mounting: Surface **OR** Suspended **OR** Recessed **OR** As indicated on Drawings, **as directed**.
   b. IV Track Mounting: Surface.
3. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches (610 mm). Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
   a. Mechanically fasten directly to bottom of concrete deck with post-installed anchors.
   b. Mechanically fasten directly to finished ceiling with toggle bolts.
   c. Mechanically fasten to furring through suspended ceiling with screw and tube spacer.
   d. Mechanically fasten to suspended ceiling grid with screws.

e. Attach track to suspended ceiling grid with manufacturer's proprietary clip.

4. Suspended Track Mounting: Install track with suspended supports at intervals of not more than 48 inches (1219 mm). Fasten support at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.
5. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
   a. Provide one locking switch unit for each pair of beds.
   b. Provide one hinged loading unit for each bed **OR** pair of beds with locking switch unit, **as directed**.
6. IV Hangers: Unless otherwise indicated, install one IV hook on each IV track and hang one IV hanger.
7. Curtain Carriers: Provide curtain carriers adequate for 6-inch (152-mm) spacing along full length of curtain plus an additional carrier.
8. Curtains: Hang curtains on each curtain track. Secure with curtain tieback, **as directed**.

B. Protection
1. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Final Completion.

END OF SECTION 10 21 16 17a

Task	Specification	Specification Description
10 21 16 17	10 21 13 13	Toilet Compartments

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SECTION 10 22 13 00 - WIRE MESH PARTITIONS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for wire mesh partitions. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Standard-duty wire mesh partitions.
b. Heavy-duty wire mesh partitions.
c. Wire mesh ceilings.
d. Wire mesh storage lockers.
e. Wire mesh stairway partitions.
f. Wire mesh equipment barriers.

C. Definitions
1. As defined in ASTM E 2016:
a. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.
b. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

D. Performance Requirements
1. Delegated Design: Design wire mesh units, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Wire mesh units shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each exposed product and for each color and texture specified.
4. Delegated-Design Submittal: For wire mesh units indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Maintenance data.

F. Quality Assurance
1. Welding Qualifications: Qualify procedures and personnel according to the following:
a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
b. AWS D1.3, "Structural Welding Code - Sheet Steel."
2. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver wire mesh items with cardboard protectors on perimeters of panels and doors and with posts wrapped **OR** palleted **OR** crated, **as directed**, to provide protection during transit and Project-site storage. Use vented plastic.
2. Inventory wire mesh partition door hardware on receipt and provide secure lockup for wire mesh partition door hardware delivered to Project site.
   a. Tag each item or package separately with identification and include basic installation instructions with each item or package.
3. Deliver keys to the Owner by registered mail or overnight package service.

1.2 PRODUCTS

A. Materials
1. Steel Wire: ASTM A 510 (ASTM A 510M).
2. Steel Plates, Channels, Angles, and Bars: ASTM A 36/A 36M.
3. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
4. Steel Pipe: ASTM A 53/A 53M, Schedule 40 unless another weight is indicated or required by structural loads.
5. Square Steel Tubing: ASTM A 500, cold-formed structural-steel tubing.
6. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
7. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.
8. Postinstalled Expansion Anchors: With capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   a. Carbon Steel: Zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition (mild).
   b. Stainless Steel: ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4), for bolts and nuts; ASTM A 276 or ASTM A 666, Type 304 or 316, for anchors.
   c. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
   d. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.
9. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated and fabricated from corrosion-resistant materials; with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by wire mesh construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
10. Seismic Bracing: Angles with legs not less than 1-1/4 inch (32 mm) wide, formed from 0.04-inch- (1-mm-) thick, metallic-coated steel sheet; with bolted connections and 1/4-inch- (6-mm-) diameter bolts.
11. Shop Primers: Provide primers that comply with Division 07..
12. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.
    a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
13. Zinc-Rich Primer: Compatible with topcoat, complying with SSPC-Paint 20 or SSPC-Paint 29.
14. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Standard-Duty Wire Mesh Partitions
1. Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-1/2-inch (38-mm) diamond mesh.

2. Vertical Panel Framing: 1-1/4-by-5/8-by-0.097-inch (32-by-16-by-2.5-mm) cold-rolled, C-shaped steel channels with 1/4-inch- (6-mm-) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing.
3. Horizontal and Vertical Panel Framing: 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels.
4. Horizontal Panel Stiffeners: 2 cold-rolled steel channels, not less than 1 by 3/8 by 1/8 inch (25 by 9.5 by 3 mm), bolted or riveted toe to toe through mesh or 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels with wire woven through.
5. Top Capping Bars: 2-1/4-by-1-inch (57-by-25-mm) cold-rolled steel channels.
6. Posts for 90-Degree Corners: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angles with 1/4-inch- (6-mm-) diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.
7. Posts for Other-Than-90-Degree Corners: Manufacturer's standard steel pipe or tubing with 1/4-inch- (6-mm-) diameter bolt holes aligning with bolt holes in vertical framing.
   a. Partitions up to 12 Feet (3.7 m) High: 1-1/4-inch (32-mm) OD.
   b. Partitions up to 20 Feet (6.1 m) High: 2-1/2-inch (65-mm) OD.
8. Adjustable Corner Posts: 2, manufacturer's standard steel pipe or tubing posts connected by steel hinges at 36 inches (900 mm) o.c. attached to posts; with 1/4-inch- (6-mm-) diameter bolt holes aligning with bolt holes in vertical framing.
9. Line Posts: 3-inch-by-4.1-lb (76-mm-by-1.9-kg) or 3-1/2-by-1-1/4-by-0.127-inch (89-by-32-by-3.2-mm) steel channels; with 5-by-18-by-1/4-inch (125-by-450-by-6-mm) steel base plates punched for attachment to floor.
10. Three- and Four-Way Intersection Posts: 1-1/4-by-1-1/4-inch (32-by-32-mm) tubular steel, with 1/4-inch- (6-mm-) diameter bolt holes aligned for bolting to adjacent panels.
11. Floor Shoes: Steel, cast iron, or cast aluminum, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
12. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels or C-channels, banded with 1-1/4-by-1/8-inch (32-by-3-mm) flat steel bar cover plates on 3 **OR** 4, **as directed**, sides, and with 1/8-inch- (3-mm-) thick angle strike bar and cover on strike jamb.
    a. Hinges: Full-surface type, 3-by-3-inch (76-by-76-mm) steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
    b. Padlock Lug: Mortised into door framing and enclosed with steel cover.
    c. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.
    d. Inactive Leaf Hardware: Cane bolt at bottom and chain bolt at top.
13. Swinging Dutch Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels or C-channels, banded with 1-1/4-by-1/8-inch (32-by-3-mm) flat steel bar cover plates on 3 **OR** 4, **as directed**, sides, and with 1/8-inch- (3-mm-) thick angle strike bar and cover on strike jamb.
    a. Hinges: Full-surface type, 3-by-3-inch (76-by-76-mm) steel, 1 pair per section of door (top and bottom); bolted, riveted, or welded to door and jamb framing.
    b. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside; mounted in lower section of door.
    c. Bolt: Mounted in, securing upper section of door.
    d. Shelf: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet, 12 inches (300 mm) deep by full width of door; with corners rounded and edges finished smooth; mounted on top of lower section of door and braced with manufacturer's standard brackets.
14. Sliding Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) steel channels or C-channels, banded with 1-1/2-by-1/8-inch (38-by-3-mm) flat steel bar cover plates on 4 sides.
    a. Hardware: Two, four-wheel roller-bearing carriers, box track, and bottom guide channel for each door.
    b. Padlock Lug: Mortised into door framing and enclosed with steel cover.

c. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.

15. Vertically Sliding Service Windows: Fabricated from same mesh and framing as panels and equipped with spring catch **OR** slide bolts, **as directed**, on each jamb that locks window in open and closed positions. Include opening frame in partition fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels or C-channels.
    a. Size: 24 inches wide by 18 inches high (600 mm wide by 450 mm high) **as directed** As indicated, **as directed**.
    b. Shelf: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet; with corners rounded and edges finished smooth; braced with manufacturer's standard brackets.
        1) Size: 24 inches wide by 12 inches deep (600 mm wide by 300 mm deep) **OR** As indicated, **as directed**.
16. Swinging Service Windows: Fabricated from same mesh and framing as panels and equipped with spring catch on strike jamb that locks window in closed position. Include opening frame in partition fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels or C-channels.
    a. Size: 24 inches wide by 18 inches high (600 mm wide by 450 mm high) **OR** As indicated, **as directed**.
    b. Shelf: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet; with corners rounded and edges finished smooth; braced with manufacturer's standard brackets.
        1) Size: 24 inches wide by 12 inches deep (600 mm wide by 300 mm deep) **OR** As indicated, **as directed**.
17. Accessories:
    a. Sheet Metal Base: Not less than 0.060-inch- (1.5-mm-) thick, cold-rolled steel sheet.
    b. Adjustable Filler Panels: Not less than 0.060-inch- (1.5-mm-) thick, cold-rolled steel sheet; capable of filling openings from 2 to 12 inches (50 to 300 mm).
    c. Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch (25 mm) of adjustment, **as directed**.
18. Finish for Uncoated Ferrous Steel: Hot-dip galvanized **OR** Hot-dip galvanized and shop primed for field painting **OR** Shop primed for field painting **OR** Shop coat **OR** Baked-enamel finish **OR** Powder-coated finish, **as directed**, unless otherwise indicated.
    a. Color: As selected from manufacturer's full range.

C. Heavy-Duty Wire Mesh Partitions
1. Mesh: 0.192-inch- (4.8-mm-) diameter, intermediate-crimp steel wire woven into 2-inch (50-mm) diamond mesh.
2. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-0.097-inch (38-by-19-by-2.5-mm) cold-rolled, C-shaped steel channels; with 3/8-inch- (9.5-mm-) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing.
3. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-1/4-inch (38-by-19-by-6-mm) cold-rolled steel channels; with 3/8-inch- (9.5-mm-) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing. Provide vertical panel stiffeners in shapes and sizes as recommended by manufacturers.
4. Horizontal Panel Stiffeners: 2 cold-rolled steel channels, not less than 1 by 1/2 by 1/8 inch (25 by 13 by 3 mm), bolted or riveted toe to toe through mesh or 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) cold-rolled steel channels with wire woven through.
5. Top Capping Bars: 3-inch-by-4.1-lb (76-mm-by-1.9-kg) hot-rolled steel channels.
6. Posts for 90-Degree Corners: 2-by-2-by-1/8-inch (50-by-50-by-3-mm) steel angles with 3/8-inch- (9.5-mm-) diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.
7. Posts for Other-Than-90-Degree Corners: Manufacturer's standard steel 2-inch- (50-mm) OD pipe or tubing with 3/8-inch- (9.5-mm-) diameter bolt holes aligning with bolt holes in vertical framing.

8. Adjustable Corner Posts: 2, manufacturer's standard steel pipe or tubing posts connected by steel hinges at 36 inches (900 mm) o.c. attached to posts; with 1/4-inch- (6-mm-) diameter bolt holes aligning with bolt holes in vertical framing.
9. Line Posts: 3-inch-by-4.1-lb (76-mm-by-1.9-kg) or 3-1/2-by-1-1/4-by-0.1265-inch (89-by-32-by-3.2-mm) steel channels; with 5-by-18-by-1/4-inch (125-by-450-by-6-mm) steel base plates punched for attachment to floor.
10. Three- and Four-Way Intersection Posts: 2-by-2-inch (50-by-50-mm) tubular steel, with 3/8-inch- (9.5-mm-) diameter bolt holes aligned for bolting to adjacent panels.
11. Floor Shoes: Steel, cast iron, or cast aluminum, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
12. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) steel channels or C-channels, banded with 1-1/2-by-1/8-inch (38-by-3-mm) flat steel bar cover plates on 4 sides, and with 1/8-inch- (3-mm-) thick angle strike bar and cover on strike jamb.
    a. Hinges: Full-surface type, 3-1/2-by-3-1/2-inch (89-by-89-mm) steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
    b. Padlock Lug: Mortised into door framing and enclosed with steel cover.
    c. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.
    d. Inactive Leaf Hardware: Cane bolt at bottom and chain bolt at top.
13. Swinging Dutch Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) steel channels or C-channels, banded with 1-1/2-by-1/8-inch (38-by-3-mm) flat steel bar cover plates on 3 **OR** 4, **as directed**, sides, and with 1/8-inch- (3-mm-) thick angle strike bar and cover on strike jamb.
    a. Hinges: Full-surface type, 3-1/2-by-3-1/2-inch (89-by-89-mm) steel, 1 pair per section of door (top and bottom); bolted, riveted, or welded to door and jamb framing.
    b. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.
    c. Bolt: Mounted in, securing upper section of door.
    d. Shelf: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet, 12 inches (300 mm) deep by full width of door; with corners rounded and edges finished smooth; mounted on top of lower section of door and braced with manufacturer's standard brackets.
14. Sliding Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) steel channels or C-channels, banded with 1-1/2-by-1/8-inch (38-by-3-mm) flat steel bar cover plates on 4 sides.
    a. Hardware: Two, four-wheel roller-bearing carriers, box track, and bottom guide channel for each door.
    b. Padlock Lug: Mortised into door framing and enclosed with steel cover.
    c. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.
15. Vertically Sliding Service Windows: Fabricated from same mesh and framing as panels and equipped with spring catch **OR** slide bolts, **as directed**, on each jamb that locks window in open and closed positions. Include opening frame in partition fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels or C-channels.
    a. Size: 24 inches wide by 18 inches high (600 mm wide by 450 mm high) **OR** As indicated, **as directed**.
    b. Shelf: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet; with corners rounded and edges finished smooth; braced with manufacturer's standard brackets.
        1) Size: 24 inches wide by 12 inches deep (600 mm wide by 300 mm deep) **OR** As indicated, **as directed**.
16. Swinging Service Windows: Fabricated from same mesh and framing as panels and equipped with spring catch on strike jamb that locks window in closed position. Include opening frame in

partition fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels or C-channels.

a. Size: 24 inches wide by 18 inches high (600 mm wide by 450 mm high) **OR** As indicated, **as directed**.

b. Shelf: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet; with corners rounded and edges finished smooth; braced with manufacturer's standard brackets.

1) Size: 24 inches wide by 12 inches deep (600 mm wide by 300 mm deep) **OR** As indicated, **as directed**.

17. Accessories:

a. Sheet Metal Base: Not less than 0.060-inch- (1.5-mm-) thick, cold-rolled steel sheet.

b. Adjustable Filler Panels: Not less than 0.0598-inch- (1.5-mm-) thick, cold-rolled steel sheet; capable of filling openings from 2 to 12 inches (50 to 300 mm).

c. Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch (25 mm) of adjustment, **as directed**.

18. Finish for Uncoated Ferrous Steel: Hot-dip galvanized **OR** Hot-dip galvanized and shop primed for field painting **OR** Shop primed for field painting **OR** Shop coat **OR** Baked-enamel finish **OR** Powder-coated finish, **as directed**, unless otherwise indicated.

a. Color: As selected from manufacturer's full range.

D. Wire Mesh Ceilings

1. Mesh, Framing, and Stiffeners: Fabricated from same mesh and framing as wire mesh partition panels.
2. Perimeter Partition Supports: 1-1/2-by-1-1/2-by-1/8-inch (38-by-38-by-3-mm) steel angle, with 1/4-inch- (6-mm-) diameter bolt holes aligned for bolting to top of wire mesh partitions and to sides of wire mesh ceiling panels.
3. Wall Supports: 1-1/2-by-1-1/2-by-1/8-inch (38-by-38-by-3-mm) steel angle punched for attachment to wall and wire mesh ceiling panels.
4. Intermediate Supports: Steel I-beam, as recommended by manufacturer.
5. Intermediate Support Posts: 2-by-2-by-1/8-inch (50-by-50-by-3-mm) steel pipe or tubing.
6. Finishes: Match adjacent wire mesh partitions.

E. Wire Mesh Storage Lockers

1. Unit Sizes:
   a. Width: 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
   b. Depth: 36 inches (914 mm) **OR** 48 inches (1219 mm) **OR** 60 inches (1524 mm), **as directed**.
   c. Height: 90 inches (2286 mm).
2. Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-1/2-inch (38-mm) diamond **OR** 1-by-2-inch (25-by-50-mm) rectangular, **as directed**, mesh.
3. Wall Panels: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angle framing on top, bottom, and back sides, and 3-by-1/8-inch (76-by-3-mm) cold-rolled steel flat bar framing on front side; with wire mesh welded to framing.
   a. Horizontal Panel Stiffeners: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angles or 3/4-by-1/4-inch (19-by-6-mm) hot-rolled steel flat bars.
4. Backs: 0.027-inch- (0.7-mm-) thick, metallic-coated steel sheet.
5. Tops: Fabricated from same mesh and framing as doors **OR** 0.027-inch- (0.7-mm-) thick, metallic-coated steel sheet, **as directed**.
6. Horizontal Dividers/Shelves: 0.043-inch- (1.1-mm-) thick, metallic-coated, **as directed**, steel sheet; with flanged edges and reinforced across width with 3/4-by-1/4-inch (19-by-6-mm) steel stiffeners, **as directed**.
7. Doors: Fabricated from same mesh as wall panels, with framing fabricated from 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angles on 4 sides; with wire mesh welded to framing. Include door strike and padlock hasp.
   a. Horizontal Stiffeners for Single-Tier Doors: 3/4-by-1/4-inch (19-by-6-mm) steel flat bars.

b. Hinges: Full-surface type, 2-1/2-by-2-1/2-inch (64-by-64-mm) steel, 1-1/2 pairs per single-tier door and 1 pair per double-tier door; bolted, riveted, or welded to door and jamb framing.

8. Finish for Uncoated Ferrous Steel: Hot-dip galvanized **OR** Hot-dip galvanized and shop primed for field painting **OR** Shop primed for field painting **OR** Shop coat **OR** Baked-enamel finish **OR** Powder-coated finish, **as directed**, unless otherwise indicated.
   a. Color: As selected from manufacturer's full range.

F. Wire Mesh Stairway Partitions
1. Standard-Duty Stairway Partitions:
   a. Diamond Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-1/2-inch (38-mm) diamond pattern and securely clinched to frames.
   b. Square Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate **OR** lock, **as directed**,-crimp steel wire woven into 1-1/2-inch (38-mm) square pattern, inserted through frame holes and welded into frame. Vertical wires are plumb, and horizontal wires are perpendicular to vertical wires.
   c. Rectangular Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate **OR** lock, **as directed**,-crimp steel wire woven into 2-by-1-inch (50-by-25-mm) rectangular pattern, inserted through frame holes and welded into frame. Vertical wires are plumb, and horizontal wires are perpendicular to vertical wires.
   d. Vertical Panel Framing: 1-1/4-by-5/8-by-0.0966-inch (32-by-16-by-2.5-mm) cold-rolled, C-shaped steel channels; with 1/4-inch- (6-mm-) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing.
   e. Horizontal Panel Framing: 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels.
   f. Horizontal Panel Stiffeners: 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels with wire woven through, or two 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels bolted or riveted toe to toe through mesh.
2. Heavy-Duty Stairway Partitions:
   a. Diamond Mesh: 0.192-inch- (4.9-mm-) diameter, intermediate-crimp steel wire woven into 2-inch (50-mm) diamond pattern and securely clinched to frames.
   b. Square Mesh: 0.192-inch- (4.9-mm-) diameter, intermediate **OR** lock, **as directed**,-crimp steel wire woven into 2-inch (50-mm) square pattern, inserted through frame holes and welded into frame. Vertical wires are plumb, and horizontal wires are perpendicular to vertical wires.
   c. Rectangular Mesh: 0.192-inch- (4.9-mm-) diameter, intermediate **OR** lock, **as directed**,-crimp steel wire woven into 2-by-1-inch (50-by-25-mm) rectangular pattern, inserted through frame holes and welded into frame. Vertical wires are plumb, and horizontal wires are perpendicular to vertical wires.
   d. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-0.0966-inch (38-by-19-by-2.5-mm) cold-rolled, C-shaped steel channels; with 3/8-inch- (9.5-mm-) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing.
   e. Horizontal Panel Stiffeners: 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) cold-rolled steel channels with wire woven through, or two 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels bolted or riveted toe to toe through mesh.
3. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) steel channels, banded with 1-1/2-by-1/8-inch (38-by-3-mm) flat steel bar cover plates on 3 **OR** 4, **as directed**, sides, and with 1/8-inch- (3-mm-) thick angle strike bar and cover on strike jamb.
   a. Hinges: Full-surface spring type, 3-1/2-by-3-1/2-inch (89-by-89-mm) steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
   b. Exit Device: As specified in Division 08 Section "Door Hardware".
   c. Tamper Shield: Fabricated from 0.097-inch- (2.5-mm-) thick, cold-rolled steel sheet; 15 inches (381 mm) high by width of door.
4. Door Jamb Framing: 2-by-2-by-1/8-inch (50-by-50-by-3-mm) steel pipe or tubing.

5. Floor Shoes: Steel, cast iron, or cast aluminum, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
6. Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch (25 mm) of adjustment, **as directed**.
7. Finish for Uncoated Ferrous Steel: Hot-dip galvanized **OR** Hot-dip galvanized and shop primed for field painting **OR** Shop primed for field painting **OR** Shop coat **OR** Baked-enamel finish **OR** Powder-coated finish, **as directed**, unless otherwise indicated.
   a. Color: As selected from manufacturer's full range.

G. Wire Mesh Equipment Barriers
1. Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-1/2-inch (38-mm) diamond **OR** 1-by-2-inch (25-by-50-mm) rectangular, **as directed**, mesh.
2. Panels: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angle framing on 4 sides, with wire mesh welded to framing.
   a. Horizontal Panel Stiffeners: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angles or 3/4-by-1/4-inch (19-by-6-mm) hot-rolled steel flat bars.
   b. Height: 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**.
3. Line and Corner Posts: 2-by-2-by-0.068-inch (50-by-50-by-1.7-mm) steel tubing with steel base plates welded to bottoms, drilled for attachment to floor, and with steel caps welded to tops.
   a. Height: Panel height plus 12-inch- (300-mm-), **as directed**, high, sweep space.
4. Swinging Gates: Fabricated from same mesh as panels, with gate framing fabricated from 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-4.7-mm) steel angles on 4 sides, and with wire mesh welded to framing.
   a. Hinges: Full-surface spring, **as directed**, type, 3-1/2-by-3-1/2-inch (89-by-89-mm) steel, 1 pair per door; bolted, riveted, or welded to door and jamb framing.
   b. Padlock Lug: Mortised into door framing and enclosed with steel cover.
   c. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.
5. Sliding Gates: Fabricated from same mesh as panels, with framing fabricated from 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-4.7-mm) steel angles on 4 sides, and with wire mesh welded to framing.
   a. Hardware: Two, four-wheel roller-bearing carriers, box track, and bottom guide channel for each door.
   b. Padlock Lug: Mortised into door framing and enclosed with steel cover.
   c. Cylinder Lock: Mortise type with manufacturer's standard cylinder **OR** cylinder specified in Division 08 Section "Door Hardware", **as directed**; operated by key outside and recessed turn knob **OR** knob **OR** lever, **as directed**, inside.
6. Finish for Uncoated Ferrous Steel: Hot-dip galvanized **OR** Hot-dip galvanized and shop primed for field painting **OR** Shop primed for field painting **OR** Shop coat **OR** Baked-enamel finish **OR** Powder-coated finish, **as directed**, unless otherwise indicated.
   a. Color: As selected from manufacturer's full range.

H. Fabrication
1. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. As required for complete installation, provide bolts, hardware, and accessories with manufacturer's standard finishes.
   a. Fabricate wire mesh items to be readily disassembled.
   b. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint **OR** finish sand **OR** remove spatter **OR** leave as applied, **as directed**.
2. Standard- and Heavy-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
   a. Mesh: Securely clinch mesh to framing.

b. Framing: Fabricate framing with mortise and tenon corner construction.
   1) Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
   2) Fabricate three- and four-way intersections using intersection posts **OR** manufacturer's standard connecting clips and fasteners, **as directed**.
   3) Fabricate partition and door framing with slotted holes for connecting adjacent panels.
c. Fabricate wire mesh partitions with 3 inches (76 mm) of clear space between finished floor and bottom horizontal framing.
d. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
e. Doors: Align bottom of door with bottom of adjacent panels.
   1) For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
f. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

3. Wire Mesh Ceilings: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
   a. Mesh: Securely clinch mesh to framing.
   b. Framing: Fabricate framing with mortise and tenon corner construction.
      1) Provide stiffeners as indicated or, if not indicated, as required by panel span and as recommended by wire mesh ceiling manufacturer. Weld stiffeners to framing.
4. Wire Mesh Stairway Partitions: Provide door jamb framing on each side of doors. Attach tamper shields centered behind exit devices.
5. Wire Mesh Storage Lockers: Fabricate initial storage locker with front and two sides. Fabricate additional storage lockers similarly, so each unit is independent **OR** as add-on units, designed to share one side with initial storage locker, **as directed**.
   a. Fabricate wall panel and door framing with slotted holes for connecting adjacent panels.
   b. Prehang doors in factory.

I. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

J. Steel And Iron Finishes
1. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   a. ASTM A 123/A 123M, for galvanizing steel and iron components.
   b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
   c. Preparation for Shop Priming: After galvanizing, thoroughly clean wire mesh components of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   a. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   b. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
3. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

4. Shop Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard one-coat, shop-coat finish suitable for use intended. Comply with paint manufacturer's written instructions for applying and curing.
   a. Color and Gloss: As selected from manufacturer's full range.
5. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish, suitable for use indicated, consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.
   a. Color and Gloss: As selected from manufacturer's full range.

1.3 EXECUTION

A. Wire Mesh Partitions Erection
1. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (305 mm) o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.
2. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (305 mm) o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.
3. Anchor wire mesh partitions to walls at 12 inches (305 mm) o.c. through back corner panel framing and as follows:
   a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   b. For hollow masonry anchorage, use toggle bolts.
   c. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
   d. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
   e. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.
4. Secure top capping bars to top framing channels with 1/4-inch- (6-mm-) diameter "U" bolts spaced not more than 28 inches (700 mm) o.c.
5. Provide line posts at locations indicated or, if not indicated, as follows:
   a. On each side of sliding door openings.
   b. For partitions that are 7 to 9 feet (2.1 to 2.7 m) high, spaced at 15 to 20 feet (4.6 to 6.1 m) o.c.
   c. For partitions that are 10 to 12 feet (3.0 to 3.7 m) high, located between every other panel.
   d. For partitions that are more than 12 feet (3.7 m) high, located between each panel.
6. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.
7. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
8. Install doors complete with door hardware.
9. Install service windows complete with window hardware.
10. Weld or bolt sheet metal bases to wire mesh partitions and doors **OR** where indicated, **as directed**.
11. Bolt accessories to wire mesh partition framing.

B. Wire Mesh Ceilings Erection
1. Anchor wall support angle to walls at 12 inches (305 mm) o.c. and as follows:
   a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

b. For hollow masonry anchorage, use toggle bolts.
c. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
d. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
e. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

2. Attach wire mesh ceiling panels to wall support angles with bolts at 12 inches (305 mm) o.c.
3. Attach wire mesh ceiling panels to wire mesh partitions with slotted angles bolted to sides of ceiling panels and to top of partitions at 12 inches (305 mm) o.c.
4. Attach wire mesh ceiling panels to intermediate supports as recommended by manufacturer.
5. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.

C. Wire Mesh Storage Lockers Erection

1. Anchor wire mesh storage lockers to floor with 3/8-inch- (9.5-mm-) diameter, expansion anchors at 12 inches (305 mm) o.c. through bottom panel framing. Shim panel framing as required to achieve level and plumb installation.
2. Anchor wire mesh storage lockers to walls at 12 inches (305 mm) o.c. through back corner panel framing and as follows:
   a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   b. For hollow masonry anchorage, use toggle bolts.
   c. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
   d. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
   e. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.
3. Attach adjacent wire mesh storage lockers to each other through side panel framing.
4. Install horizontal dividers/shelving in double-tier storage lockers.
5. Install doors complete with door hardware.

D. Wire Mesh Stairway Partitions Erection

1. Anchor wire mesh stairway partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (305 mm) o.c. through floor shoes located at each post. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.
2. Anchor angle clips supporting wire mesh stairway partitions at stairs and intermediate landings with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (305 mm) o.c. Weld stairway partition framing to angle clips.
3. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.
4. Install doors complete with door hardware.

E. Wire Mesh Equipment Barriers Erection

1. Anchor wire mesh equipment barriers to floor with 3/8-inch- (9.5-mm-) diameter, expansion anchors through post bases. Shim post bases as required to achieve level and plumb installation.
2. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.
3. Install gates complete with gate hardware.

F. Adjusting And Cleaning

1. Adjust doors **OR** gates **OR** service windows, **as directed**, to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.
2. Remove and replace defective work including doors and framing that are warped, bowed, or otherwise unacceptable.
3. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
4. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 10 22 13 00

SECTION 10 22 19 13 - DEMOUNTABLE PARTITIONS

1.1 GENERAL

A. Description Of Work:
1. This specification covers the furnishing and installation of materials for demountable partitions. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
a. Demountable site-assembled partitions.
b. Demountable unitized-panel partitions.

C. Performance Requirements
1. Structural Performance: Provide demountable partitions capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
a. Load-Bearing Capacity of Panel System: Not less than 300-lb (136-kg concentrated) **OR** 2.3-lb/linear inch (0.041-kg/linear mm) distributed, **as directed**, proof load when tested according to BIFMA X 5.6, Section 6, Table 1.
b. Transverse-Load Capacity of Panel System: Lateral deflection of not more than 1/120 **OR** 1/240, **as directed**, of the overall span when tested under a uniformly distributed load of 5 lb/sq. ft. (24.4 kg/sq. m) according to ASTM E 72.
c. Seismic Performance: Provide demountable partitions capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

D. Submittals
1. Product Data: For each type of product indicated.
2. Shop Drawings: For demountable partitions. Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each type of exposed finish required.
4. Product Test Reports.
5. Maintenance Data.

E. Quality Assurance
1. Sound Transmission Characteristics: Where STC ratings are indicated, provide partitions with STC rating that was determined by testing an identical system according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
2. Fire-Test-Response Characteristics: Provide demountable partitions complying with the following requirements:
a. Where indicated, provide demountable partitions identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or a testing and inspecting agency acceptable to authorities having jurisdiction.
1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
b. Surface-Burning Characteristics: Provide demountable partitions per ASTM E 84:
1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 450 or less.
3. Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.
a. Test Pressure:

1) Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
OR
Test according to NFPA 252 or UL 10C. After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

b. As scheduled on Drawings.

4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Demountable Site-Assembled Partitions

1. Face Panels: Manufacturer's standard **OR** Gypsum board, ASTM C 36/C 36M **OR** Wood composite **OR** Fiber composite **OR** Steel-sheet-faced gypsum board, ASTM C 36/C 36M **OR** Stainless-steel-sheet-faced gypsum board, ASTM C 36/C 36M**, as directed**.
   a. Thickness: Manufacturer's standard **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm)**, as directed**.
   b. Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** As indicated**, as directed**.
   c. Finish: Unfinished **OR** Manufacturer's standard prime-coat finish ready for field painting **OR** Vinyl wall covering complying with CFFA-W-101-A **OR** Fabric **OR** Factory-applied paint finish **OR** Powder-coat finish **OR** No. 4 satin**, as directed**.
   d. Colors, Textures, and Patterns: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
2. Accessory Panels: Manufacturer's standard fabric-covered tackable panels **OR** porcelain-enamel chalkboard and markerboard panels**, as directed**.
3. Framing: Studs, top and bottom track, 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** manufacturer's standard**, as directed**, deep.
   a. Steel: Metallic-coated, 0.0359-inch (0.912-mm) base metal thickness.
   b. Aluminum.
   c. Fiberglass.
4. Panel Joint Closure: Manufacturer's standard **OR** Vinyl **OR** Aluminum **OR** Steel**, as directed**.
5. Trim: Continuous, factory-finished, snap-on type; adjustable for variations in floor level **OR** floor and ceiling levels**, as directed**.
   a. Outside Corner Trim: Square **OR** Radiused**, as directed**.
   b. Base: Snap-on vinyl **OR** metal**, as directed**.
   c. Base Trim Profile: Recessed **OR** Projected **OR** Flush**, as directed**.
   d. Ceiling Trim Profile: Recessed **OR** Projected**, as directed**.
   e. Cornice Trim: Continuous over tops of partial-height units for maximum stability.
   f. Exposed-Metal Trim Finish: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
   g. Trim Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
6. Doors: As specified in Division 12.
7. Door Frames: Manufacturer's standard steel **OR** aluminum**, as directed**, reversible**, as directed**, factory mortised to receive hardware**, as directed**, for 1-3/4-inch (45-mm) doors.
   a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
   b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.

8. Fire-Protection Rating of Rated Door Assemblies: Labeled 20 **OR** 45**, as directed**, minutes.
9. Hardware: As specified in Division 08 Section "Door Hardware".
10. Glazing Frames: Manufacturer's standard **OR** Match door frames**, as directed**, for glazing thickness indicated.
    a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
    b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
11. Glazing: Fully tempered clear float glass **OR** Laminated clear float glass **OR** Glass type indicated**, as directed**, complying with Division 08 Section "Glazing".
12. Acoustical Rating: STC 35, unless directed otherwise.
13. Fire-Resistance Rating of Partition Assemblies: 1 hour.
14. Seals: Manufacturer's standard **OR** Open cell, 2 lb/cu. ft. (32 kg/cu. m)**, as directed**.

B. Demountable Unitized-Panel Partitions
1. Panels: Manufacturer's standard **OR** Gypsum board, ASTM C 36/C 36M **OR** Wood composite **OR** Fiber composite **OR** Steel-sheet-faced gypsum board, ASTM C 36/C 36M **OR** Stainless-steel-sheet-faced gypsum board, ASTM C 36/C 36M**, as directed**.
    a. Type: Unfinished **OR** Factory finished **OR** Metal faced**, as directed**.
    b. Thickness: Manufacturer's standard **OR** 1-3/4 inches (45 mm) **OR** 2-1/4 inches (57 mm)**, as directed**.
    c. Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** As indicated**, as directed**.
    d. Finish: Vinyl wall covering complying with CFFA-W-101-A **OR** Fabric **OR** Factory-applied paint finish **OR** Powder-coat finish **OR** Stainless steel**, as directed**.
    e. Colors, Textures, and Patterns: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
2. Accessory Panels: Manufacturer's standard fabric-covered tackable panels **OR** porcelain-enamel chalkboard and markerboard panels**, as directed**.
3. Framing: Manufacturer's standard **OR** Steel **OR** Aluminum**, as directed**.
    a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
    b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
4. Panel Joint Closure: Manufacturer's standard **OR** Flush **OR** Vinyl **OR** Aluminum **OR** Steel**, as directed**.
5. Trim: Continuous, factory-finished, snap-on type; adjustable for variations in floor level **OR** floor and ceiling levels**, as directed**.
    a. Base Trim Profile: Recessed **OR** Projected **OR** Flush**, as directed**.
    b. Ceiling Trim Profile: Recessed **OR** Projected**, as directed**.
    c. Cornice Trim: Continuous over tops of partial-height units for maximum stability.
    d. Exposed-Metal Trim Finish: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
    e. Colors: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
6. Doors: Manufacturer's standard solid-core wood **OR** steel **OR** glazed**, as directed**, 1-3/4 inches (45 mm) thick.
    a. Door Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
    b. Door Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.

7. Door Frames: Manufacturer's standard steel **OR** aluminum**, as directed**, reversible**, as directed**, factory mortised to receive hardware**, as directed**, for 1-3/4-inch (45-mm) doors.
   a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
   b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
8. Hardware: As specified in Division 08 Section "Door Hardware".
9. Glazing Frames: Manufacturer's standard **OR** Match door frames**, as directed**, for glazing thickness indicated.
   a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting**, as directed**.
   b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range**, as directed**.
10. Glazing: Fully tempered clear float glass **OR** Laminated clear float glass **OR** Glass type indicated**, as directed**, complying with Division 08 Section "Glazing".
11. Acoustical Rating: STC 35, unless directed otherwise.
12. Seals: Manufacturer's standard **OR** Open cell, 2 lb/cu. ft. (32 kg/cu. m)**, as directed**.

C. Fabrication
1. Demountable Site-Assembled Panels: Fabricate each panel from one sheet **OR** two sheets**, as directed**, of gypsum board.
   a. Transom Panels: Fabricate in material and finish to match wall panels, unless otherwise indicated.
2. Demountable Unitized Panels: Factory-assembled, flush, hollow unit construction; with faces smooth and free of buckles, oil canning, and seams; and insulated with solidly packed, inorganic, mineral filler. Fabricate panels for installation with concealed fastening devices and pressure-fit components that will not damage ceiling or floor coverings. Fabricate panels with continuous light-and-sound seals at floor, ceiling, and other locations where panels abut fixed construction.
   a. Factory glaze panels to the greatest extent possible.
3. Components: Fabricate components for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings. Fabricate for installation with continuous seals at floor, ceiling, and other locations where partition assemblies abut fixed construction and for installation of sound attenuation insulation in partition cavities.

D. Finishes, General
1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Installation
1. Install demountable partition systems rigid, level, plumb, and aligned. Install seals to prevent light and sound transmission at connections to floors, ceilings, fixed walls, and abutting surfaces.
   a. Installation Tolerance: Install each demountable partition so surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent partitions.
2. Do not alter ceiling suspension system **OR** Make alterations to ceiling suspension system required by partition installation or to gain access to electrical or communication systems without

affecting the structural integrity of ceiling suspension system. Make alterations so they are not noticeable after panel installation**, as directed**.

3. Install door-and-frame and glazing-and-glazing-frame assemblies securely anchored to partitions and with doors aligned and fitted. Install and adjust door hardware for proper operation.
   a. Install fire-rated door frames according to NFPA 80.

END OF SECTION 10 22 19 13

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Task	Specification	Specification Description
10 22 19 43	10 22 19 13	Demountable Partitions
10 22 19 53	10 22 19 13	Demountable Partitions
10 22 23 23	10 22 19 13	Demountable Partitions

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SECTION 10 22 43 00 - OPERABLE PANEL PARTITIONS

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for operable panel partitions. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Manually operated, acoustical panel partitions.
b. Electrically operated, acoustical panel partitions.
c. Manually operated, fire-rated panel partitions.
d. Manually operated, glass panel partitions.

C. Definitions
1. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."
2. Glass and Glazing Definitions: See Division 08 Section "Glazing".
3. NIC: Noise Isolation Class.
4. NRC: Noise Reduction Coefficient.
5. STC: Sound Transmission Class.

D. Performance Requirements
1. Delegated Design: Design operable panel partitions, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
a. The term "withstand" means "the panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."
3. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
a. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
b. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.
c. Acoustical Performance Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for 10 dB less than STC value indicated.
4. Fire Resistance: Provide fire-rated operable panel partition assemblies including pass doors with fire-resistance ratings indicated.
a. Pass Doors: Provide doors in fire-rated operable panel partition assemblies with fire-resistance ratings indicated. Pass doors shall meet positive-pressure requirements.

E. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:

a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that operable panel partitions comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
b. Product Data for Credit EQ 4.4: For each composite wood product used in operable panel partitions, documentation indicating that product contains no urea formaldehyde.

3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   a. For installed products indicated to comply with design loads, include structural analysis data for attachments, signed and sealed by the qualified professional engineer responsible for their preparation.
   b. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
   c. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each type of exposed material, finish, covering, or facing indicated.
5. Delegated-Design Submittal: For operable panel partitions indicated to comply with performance requirements, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.
   a. Design Calculations: Calculate requirements for seismic restraints.
6. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, based on input from installers of the items involved:
7. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
8. Seismic Qualification Certificates: For operable panel partitions, accessories, and components, from manufacturer.
9. Product Certificates.
10. Product Test Reports.
11. Field quality-control reports.
12. Operation and Maintenance Data.
13. Warranty: Sample of special warranty.

F. Quality Assurance
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Qualifications: An employer of workers trained and approved by manufacturer.
3. Forest Certification: Fabricate products with wood, wood veneers, and wood-based panel products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Fire-Test-Response Characteristics: Provide panels with finishes meeting one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   a. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
      1) Flame-Spread Index: 25 or less **OR** 26 to 75 **OR** 76 to 200, **as directed**.
      2) Smoke-Developed Index: 450 or less.
   b. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 **OR** NFPA 286, **as directed**.
5. Fire-Rated Door Assemblies: Comply with NFPA 80, based on testing according to UL 10B.
   a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
7. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Steel Frame: Steel sheet, manufacturer's standard **OR** 0.0508-inch (1.3-mm) **OR** 0.0641-inch (1.6-mm) **OR** 0.0747-inch (1.9-mm), **as directed**, nominal minimum thickness for uncoated steel.
2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard **OR** minimum 0.0299-inch (0.75-mm) **OR** 0.0359-inch (0.9-mm) **OR** 0.0478-inch (1.2-mm) **OR** 0.0598-inch (1.5-mm) **OR** 0.0747-inch (1.9-mm), **as directed**, nominal minimum thickness for uncoated steel.
3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 (ASTM B 221M) for extrusions; manufacturer's standard strengths and thicknesses for type of use.
   a. Frame Reinforcement: Manufacturer's standard steel or aluminum.
4. Wood Frame: Clear, vertical-grain, straight, kiln-dried, wood **OR** fire-retardant-treated wood, **as directed**; of manufacturer's standard species **OR** one of the following species, **as directed**:
   a. Cherry.
   b. Hemlock.
   c. Maple.
   d. Meranti.
   e. Poplar.
   f. Red oak.
5. Gypsum Board: ASTM C 36/C 36M.
6. Cement Board: ASTM C 1288.
7. Plywood: DOC PS 1.
8. Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde.
9. Medium-Density Fiberboard: ANSI A208.2, made with binder containing no urea formaldehyde.

B. Operable Acoustical Panels
1. Operable Acoustical Panels: Operable acoustical panel partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
2. Panel Operation: Manually operated, individual **OR** Manually operated, paired **OR** Manually operated, continuously hinged **OR** Electrically operated, continuously hinged, **as directed**, panels.
3. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
4. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
   a. Panel Width: Standard widths **OR** Equal widths **OR** As indicated, **as directed**.
5. STC: Not less than 38 **OR** 41 **OR** 45 **OR** 47 **OR** 50 **OR** 52 **OR** 54, **as directed**.
6. NRC: Not less than 0.50 **OR** 0.60 **OR** 0.65 **OR** 0.90, **as directed**.
7. Panel Weight: 8 lb/sq. ft. (40 kg/sq. m) **OR** 10 lb/sq. ft. (50 kg/sq. m) **OR** 12 lb/sq. ft. (59 kg/sq. m), **as directed**, maximum.
8. Panel Thickness: Not less than 3 inches (75 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm), **as directed**.

9. Panel Closure: Manufacturer's standard.
   a. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal **OR** Fixed jamb **OR** As indicated, **as directed**.
   b. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal **OR** Hinged jamb closure **OR** Hinged communicating panel **OR** Fixed jamb **OR** Angle jamb **OR** Flexible, resilient PVC, bulb-shaped acoustical seal, **as directed**.
10. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
    a. Hinges: Manufacturer's standard **OR** Concealed (invisible), **as directed**.
    b. Exit Device: Manufacturer's standard.

C. Operable Fire-Rated Panels
1. Operable Fire-Rated Panels: Operable fire-rated acoustical panel partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
2. Panel Operation: Manually operated, individual **OR** Manually operated, paired, **as directed**, panels.
3. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
4. Dimensions: Fabricate operable fire-rated panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
   a. Panel Width: Standard widths **OR** Equal widths **OR** As indicated, **as directed**.
5. Fire Rating: 1 hour **OR** 2 hours, **as directed**.
6. STC: Not less than 38 **OR** 41 **OR** 45 **OR** 47 **OR** 50 **OR** 52 **OR** 54, **as directed**.
7. NRC: Not less than 0.50 **OR** 0.60 **OR** 0.65 **OR** 0.90, **as directed**.
8. Panel Weight: 8 lb/sq. ft. (40 kg/sq. m) **OR** 10 lb/sq. ft. (50 kg/sq. m) **OR** 12 lb/sq. ft. (59 kg/sq. m), **as directed**, maximum.
9. Panel Thickness: Not less than 3 inches (75 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm), **as directed**.
10. Panel Closure: Manufacturer's standard fire-rated closure.
    a. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal **OR** Fixed jamb **OR** As indicated, **as directed**.
    b. Final Closure: Fire-rated, constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal **OR** hinged jamb closure **OR** hinged communicating panel **OR** fixed jamb **OR** angle jamb **OR** flexible, resilient PVC, bulb-shaped acoustical seal, **as directed**.
11. Hardware: Manufacturer's standard as required to operate fire-rated operable panel partition and accessories; with decorative, protective finish.
    a. Hinges: Manufacturer's standard **OR** Concealed (invisible), **as directed**.
    b. Exit Device: Manufacturer's standard.

D. Operable Glass Panels
1. Operable Glass Panels: Operable frameless aluminum **OR** aluminum-framed **OR** wood-framed, **as directed**, glass panel partition system with acoustical properties, **as directed**, including panels, seals, **as directed**, suspension system, operators, and accessories.
2. Panel Operation: Manually operated, individual **OR** Manually operated, paired **OR** Manually operated, continuously hinged, **as directed**, panels.
3. Panel Construction: Manufacturer's standard glazed panels, reinforced as required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

a. Factory-Glazed Fabrication: Glaze operable glass panels in the factory where practical and possible for applications indicated. Comply with manufacturer's written requirements and with requirements in Division 08 Section "Glazing".

4. Glass and Glazing:
   a. Safety Glass: Provide glass products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.
   b. Glass: Manufacturer's standard **OR** Custom, **as directed**, glass and glass assemblies as indicated and complying with the following:
      1) Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Type I (transparent flat glass), Class 1 (clear) **OR** Class 2 (tinted), **as directed**, Quality-Q3.
      2) Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II (patterned flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.
      3) Laminated Glass: ASTM C 1172, with clear **OR** colored **OR** patterned **OR** graphic, **as directed**, interlayer.
         a) Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Class 1 (clear) **OR** Class 2 (tinted), **as directed**, Quality-Q3.
         b) Patterned Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.
      4) Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass as indicated, separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units.
         a) Spacer Specifications: Manufacturer's standard spacer material and construction.
         b) Spacer Specifications: Manufacturer's standard spacer construction and material as follows: Aluminum with mill or clear anodic finish **OR** Aluminum with black, color anodic finish **OR** Aluminum with bronze, color anodic finish **OR** Aluminum with powdered-metal paint finish in color selected **OR** Galvanized steel **OR** Stainless steel, **as directed**.
      5) Glass Thickness: Manufacturer's standard thickness for indicated requirements **OR** As indicated **OR** 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1 inch (25 mm) **OR** 2-1/4 inches (57 mm), **as directed**.
      6) Glass Vertical Edge: Polished **OR** Manufacturer's standard, permanently adhered edge trim, **as directed**.
   c. Glazing System: Manufacturer's standard factory-glazing system **OR** Manufacturer's standard factory-glazing system that produces acoustical seal **OR** Manufacturer's standard factory-glazing system as indicated, **as directed**.
5. Dimensions: Fabricate operable glass panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
   a. Panel Width: Standard widths **OR** Equal widths **OR** As indicated, **as directed**.
6. STC: Not less than 36 **OR** 41 **OR** 46 **OR** 48, **as directed**.
7. Panel Weight: 8 lb/sq. ft. (40 kg/sq. m) **OR** 20 lb/sq. ft. (98 kg/sq. m), **as directed**, maximum.
8. Panel Frame Thickness: Maximum 1-7/8 inches (48 mm) **OR** 2-1/4 inches (57 mm) **OR** 3-3/4 inches (96 mm), **as directed**.
9. Panel Closure: Manufacturer's standard.
10. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
11. Finishes:
    a. Exposed Metal: Match sample **OR** As selected from manufacturer's full range, **as directed**, as follows:
       1) Aluminum: Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Baked powder coating, **as directed**.

2) Metal-Clad Aluminum: Satin stainless steel **OR** Polished stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.

b. Wood Finish: Match sample **OR** As selected from manufacturer's full range, **as directed**, as follows:

1) Type: Transparent finish **OR** Transparent finish over stain, **as directed**, over wood variety indicated.

E. Seals

1. General: Provide types of seals indicated that produce operable panel partitions complying with acoustical and fire-resistive performance requirements, **as directed**, and the following:
   a. Manufacturer's standard seals.
   b. Seals made from materials and in profiles that minimize sound leakage.
   c. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
2. Vertical Seals: Deep-nesting, interlocking steel, **as directed**, astragals mounted on each edge of panel, with continuous PVC acoustical seal.
3. Horizontal Top Seals:
   a. Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.
      OR
      PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.
      OR
      Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track or PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.
4. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
   a. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**, between retracted seal and floor finish.
      OR
      Mechanically Operated for Fire-Rated Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 4 inches (102 mm), **as directed**, between retracted seal and floor finish.
      OR
      Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, between retracted seal and floor finish.

F. Finish Facing

1. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
   a. Apply facings **OR** one-piece, seamless facings, **as directed**, free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and **OR** with invisible seams complying with Shop Drawings for location, and, **as directed**, with no gaps or overlaps. Horizontal butted edges **OR** seams, **as directed**, are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

b. Where facings with directional or repeating patterns or directional weave **OR** directional, repeating, or matching grain, **as directed**, are indicated, mark facing top and attach facing in same direction.
c. Match facing pattern 72 inches (1830 mm) above finished floor.
d. Color/Pattern: Match samples **OR** As selected from manufacturer's full range, **as directed**.

2. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.
   a. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
3. Carpet Wall Covering: Manufacturer's standard nonwoven, needle-punched carpet with fibers fused to backing, from same dye lot, treated to resist stains.
4. Fabric Wall Covering: Manufacturer's standard fabric **OR** 100 percent polyolefin woven fabric, **as directed**, from same dye lot, treated to resist stains.
5. High-Pressure Decorative Laminate: NEMA LD 3, Horizontal grade.
6. Wood Veneer: Laminated to noncombustible **OR** fire-retardant-treated wood, **as directed**, core with moisture-resistant adhesive, of wood species indicated.
   a. Wood Finish: Match sample **OR** As selected from manufacturer's full range, **as directed**, as follows:
      1) Type: Transparent finish **OR** Transparent finish over stain, **as directed**, over wood variety indicated.
7. Paint: Manufacturer's standard factory-painted finish.
   a. Color: As indicated **OR** As selected, **as directed**.
8. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:
   a. Steel, Painted: Finished with manufacturer's standard neutral color **OR** Matching sample **OR** As selected from manufacturer's full range, **as directed**.
   b. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper required to comply with performance requirements; and with manufacturer's standard mill **OR** clear anodic **OR** color anodic, **as directed**, finish.
9. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

G. Suspension Systems
1. Suspension Tracks: Steel or aluminum mounted directly to overhead structural support, **OR** with adjustable steel hanger rods for overhead support, **as directed**, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
   a. Panel Guide: Aluminum; finished with factory-applied, decorative, protective finish.
   b. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish **OR** primed for field finish, **as directed**.
2. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
   a. Multidirectional Carriers: Capable of negotiating 90-degree L, T, and X intersections without track switches.
3. Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
   a. Curve-and-Diverter Switches: Allowing radius turns to divert panels to an auxiliary track.
   b. L Intersections: Allowing panels to change 90 degrees in direction of travel.
   c. T Intersections: Allowing panels to pass through or change 90 degrees to another direction of travel.

d. X Intersections: Allowing panels to pass through or change travel direction full circle in 90-degree increments, and allowing 1 partition to cross track of another.
e. Multidirectional Switches: Adjustable switch configuring track into L, T, or X intersections and allowing panels to be moved in all pass-through, 90-degree change, and cross-over travel direction combinations.
f. Center carrier stop.

4. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
5. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

H. Electric Operators
1. General: Provide factory-assembled electric operation system of size and capacity recommended and provided by operable panel partition manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, chain drive, remote-control stations, control devices, and accessories required for proper operation. Include wiring from motor control to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
2. Comply with NFPA 70.
3. Control Equipment: Complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
4. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
   a. Voltage: 120 V **OR** 208-220 V **OR** NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected, **as directed**.
   b. Horsepower: 1/4 **OR** 1/3 **OR** 3/4 **OR** Manufacturer's standard, **as directed**.
   c. Efficiency: Standard **OR** Premium, **as directed**.
   d. Enclosure: Open dripproof **OR** Totally enclosed **OR** Manufacturer's standard, **as directed**.
   e. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
   f. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
   g. Phase: Single **OR** Polyphase, **as directed**.
5. Remote-Control Stations: Two single-key-operated, constant-pressure control stations located remotely from each other on opposite sides and opposite ends of partition run. Wire in series to require simultaneous activation of both key stations to operate partition. Each three-position control station labeled "Open," "Close," and "Off **OR** Stop, **as directed**." Provide two keys per station.
6. Obstruction-Detection Devices: Provide each motorized operable panel partition with automatic safety sensor indicated, that causes operator to immediately shut off motor **OR** stop and reverse direction, **as directed**.
   a. Sensor Edge: Contact-pressure-sensitive safety edge along partition's leading edge.
   b. Sensor Mat: Electrically operated, contact-weight-sensitive safety mat in storage pocket area.
   c. Infrared Sensor System: Designed to detect an obstruction in partition's path and sound an audible alarm, without obstruction contacting partition.
7. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop operable panel partition at fully extended and fully stacked positions.
8. Emergency Release Mechanism: Quick disconnect-release of electric-motor drive system, permitting manual operation in event of operating failure.

I. Accessories
1. Pass Doors: Fabricated to comply with recommendations in ICC/ANSI A117.1 **OR** the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, **as directed**. Swinging door built into and matching panel materials, **OR** construction, **OR**

acoustical qualities, **OR** fire rating, **as directed**, finish, and thickness, complete with frames and operating hardware. Hinges finished to match other exposed hardware.

a. Single Pass Door: 36 by 80 inches (914 by 2032 mm) **OR** 36 by 84 inches (914 by 2134 mm), **as directed**, with the following:

b. Double Pass Door: 72 by 80 inches (1829 by 2032 mm) **OR** 72 by 84 inches (1829 by 2134 mm), **as directed**, with the following:

1) Door Seals: Mechanically operated floor seal on panels containing pass doors **OR** Sweep floor seals, **as directed**.
2) Panic **OR** Fire, **as directed**, exit device.
3) Concealed door closer.
4) Door Viewer: Installed with view in direction of swing.
5) Exit Sign: Recessed, self-illuminated.
6) Latchset: Passage set.
7) Lock: Key-operated lock cylinder, keyed to master key system, **as directed**, operable from both sides of door. Include two keys per lock.
OR
Lock: Deadlock to receive cylinder, operable from both sides of door. Refer to Division 12 for lock cylinder and keying requirements.

2. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs, **as directed**. Hinges in finish to match other exposed hardware.
   a. Manufacturer's standard method to secure storage pocket door in closed position.
   OR
   Rim Lock: Key-operated lock cylinder, keyed to master key system, **as directed**, to secure storage pocket door in closed position. Include two keys per lock.
   OR
   Rim Lock: Deadlock to receive cylinder, to secure storage pocket door in closed position. Refer to Division 12 for lock cylinder and keying requirements.
3. Electric Interlock: Provide each motorized operable panel partition with electric interlocks at locations indicated, to prevent operation of operable panel partition under the following conditions:
   a. On storage pocket door, to prevent operation if door is not in fully open position.
   b. On partitions at location of convergence by another partition, to prevent operation if merging partitions are in place.
4. Windows: Manufacturer's standard **OR** As indicated, **as directed**.
5. Work Surfaces: Quantities, placement, and size indicated.
   a. Surface: Porcelain steel marker/projection surface **OR** Self-healing, tackable, vinyl-coated fabric wall covering, complying with CFFA-W-101-D, Type II, and indicated fire-test-response characteristics; laminated to natural cork tackboard, **as directed**.
   b. Surface Color: Matching sample **OR** As selected from manufacturer's full range, **as directed**.
   c. Size: Full width and height of panel **OR** Full width of panel by 48 inches (1219 mm) **OR** 48 by 48 inches (1219 by 1219 mm) **OR** As indicated on Drawings, **as directed**.
   d. Trim: Aluminum slip-on or snap-on trim with no visible screws or exposed joints and with corners mitered to a neat, hairline joint.
6. Chalk Tray and Eraser Pocket, **as directed**: Manufacturer's standard.
   a. Aluminum with mill **OR** clear anodic **OR** color anodic, **as directed**, finish.
7. Chair Rails: Recessed **OR** Surface mounted, **as directed**, in locations indicated on Drawings.
8. Vertical Edge Trim: Manufacturer's standard transparent **OR** thin aluminum astragal, **as directed**, trim to protect vertical edges of glass in frameless panels.

1.3 EXECUTION

A. Installation

1. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
2. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
3. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
4. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
5. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

B. Adjusting
1. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware, electric operator, **as directed**, and other moving parts.
2. Adjust pass doors and storage pocket doors, **as directed**, to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.

C. Field Quality Control
1. This paragraph is applicable if sound control is critical. Installer shall conduct a light-leakage test at completion of installation, and prior to NIC testing, to correct alignment of vertical joints and top and bottom seals.
2. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.
3. NIC Testing: Engage a qualified testing agency to perform tests and inspections.
4. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
5. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.
6. Repair or replace operable panel partitions that do not comply with requirements.
7. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.
8. Prepare test and inspection reports.

D. Cleaning
1. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

END OF SECTION 10 22 43 00

SECTION 10 26 13 00 - IMPACT-RESISTANT WALL PROTECTION

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for impact-resistant wall protection. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Wall guards.
b. Impact-resistant handrails.
c. Bed locators.
d. Corner guards.
e. Impact-resistant wall coverings.
f. Door protection systems.

C. Performance Requirements
1. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

D. Submittals
1. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
2. LEED Submittals:
a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood rails comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
1) Include statement indicating costs for each certified wood product.
b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
c. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that products contain no urea formaldehyde.
3. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
a. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Samples: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.
a. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.
b. Handrails: 12 inches (300 mm) long. Include examples of joinery, corners, and field splices.
c. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.
d. Door-Surface Protection: 6 by 6 inches (150 by 150 mm) square.
e. Door-Edge and -Frame Protectors: 12 inches (300 mm) long.
f. Door-Knob and -Lever Protectors: Full-size unit of each type.

5. Qualification Data: For qualified Installer and testing agency.
6. Material Certificates: For each impact-resistant plastic material, from manufacturer.
7. Material Test Reports: For each impact-resistant plastic material.
8. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   a. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.
9. Warranty: Sample of special warranty.

E. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
3. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated.
   a. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
4. Forest Certification: Fabricate wood rails from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
5. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
6. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
7. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling
1. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   a. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
   b. Keep plastic sheet material out of direct sunlight.
   c. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
      1) Store corner-guard covers in a vertical position.
      2) Store wall-guard, bed-locator and handrail covers in a horizontal position.

G. Project Conditions
1. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      1) Structural failures.

2) Deterioration of plastic and other materials beyond normal use.

b. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.
   a. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
   b. Chemical and Stain Resistance: Tested according to ASTM D 543 **OR** ASTM D 1308.
   c. Self-extinguishing when tested according to ASTM D 635.
   d. Flame-Spread Index: 25 or less.
   e. Smoke-Developed Index: 450 or less.
2. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.
3. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.
4. Stainless-Steel Sheet: ASTM A 240/A 240M.
5. Brass: ASTM B 249/B 249M for extruded shapes and ASTM B 36/B 36 M for sheet.
6. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.
7. Particleboard: ANSI A208.1, Grade M-2; made with binder containing no urea formaldehyde.
8. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
9. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Wall Guards

1. Crash Rail: Heavy-duty assembly consisting of continuous snap-on plastic cover installed over concealed retainer system; designed to withstand impacts.
   a. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Flat **OR** Convex, **as directed**.
         a) Dimensions: Nominal 6 inches high by 1 inch deep (150 mm high by 25 mm deep) **OR** 8 inches high by 1 inch deep (200 mm high by 25 mm deep), **as directed**.
         b) Surface: Uniform **OR** Uniform with coextruded accent inlay strip in contrasting color **OR** Grooved, **as directed**.
            i. Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
      2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Continuous Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
      OR
      Retainer Clips: Manufacturer's standard impact-absorbing clips designed for heavy-duty performance.
   c. Bumper: Continuous rubber or vinyl bumper cushion(s).

d. End Caps and Corners: Prefabricated, injection-molded plastic; matching color **OR** contrasting with color, **as directed**, cover; field adjustable for close alignment with snap-on cover.
e. Accessories: Concealed splices and mounting hardware.
f. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushion(s) **OR** Extended mounting on injection-molded plastic mounting brackets, **as directed**.

2. Bumper Rail: Assembly consisting of continuous snap-on plastic cover installed over concealed, continuous retainer; designed to withstand impacts.
   a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Half round profile, nominal 1 inch high by 1 inch deep (25 mm high by 25 mm deep) **OR** Rounded bullnose profile, nominal 4 inches high by 2 inches deep (100 mm high by 50 mm deep) **OR** Angled profile with rounded-bullnose front edge, nominal 4 inches high by 2 inches deep (100 mm high by 50 mm deep) **OR** Flat profile, nominal 4 inches high by 1 inch deep (100 mm high by 25 mm deep), **as directed**.
      2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Continuous Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
      OR
      Retainer Clips: Manufacturer's standard impact-absorbing clips.
   c. Bumper: Continuous rubber or vinyl bumper cushion(s).
   d. End Caps and Corners: Prefabricated, injection-molded plastic; matching color **OR** contrasting with color, **as directed**, cover; field adjustable for close alignment with snap-on cover.
   e. Accessories: Concealed splices and mounting hardware.
   f. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushions **OR** Extended mounting on injection-molded plastic mounting brackets, **as directed**.

3. Rub Rail: Assembly consisting of continuous snap-on cover installed over concealed, continuous retainer.
   a. Cover: Extruded rigid plastic **OR** flexible PVC, **as directed**, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Half-round profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep) **OR** Rounded bullnose profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep), **as directed**.
      2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
   c. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
   d. Accessories: Concealed splices and mounting hardware.
   e. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushions, **as directed**.

4. Wood Chair Rail with Bumper: Assembly consisting of continuous sculpted, solid-wood rail, with continuous bumper insert installed in continuous recessed retainer.
   a. Wood Rail: 3-1/2 inches high by 7/8 inch deep (89 mm high by 22 mm deep) **OR** 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** Size and profile indicated on Drawings, **as directed**.
      1) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech, **as directed**.
      2) Finish: Clear **OR** Stained, **as directed**.
      3) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

b. Bumper: Extruded rigid plastic **OR** flexible vinyl, **as directed**, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
   1) Profile: Half-round profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep) **OR** Small rounded profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep), **as directed**.
   2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   3) End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.

c. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
   1) Finish: Mill **OR** Brass colored, **as directed**.

d. Accessories: Concealed splices and mounting hardware.

e. Mounting: Surface mounted directly to wall.

5. Wood Chair Rail: Assembly consisting of continuous sculpted, solid-wood rail.
   a. Rail: 3-1/2 inches high by 7/8 inch deep (89 mm high by 22 mm deep) **OR** 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** As indicated on Drawings, **as directed**.
      1) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Bamboo, **as directed**.
      2) Finish: Clear **OR** Stained, **as directed**.
      3) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Accessories: Concealed splices and mounting hardware.
   c. Mounting: Surface mounted directly to wall.
6. Opaque-Plastic Chair Rail: Assembly consisting of continuous snap-on cover installed over continuous retainer.
   a. Cover: Extruded rigid plastic, minimum 0.070-inch (1.8-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Rounded bullnose profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep) **OR** Half-round profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep), **as directed**.
      2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
   c. Bumper: Continuous rubber or vinyl bumper cushion(s).
   d. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
   e. Accessories: Concealed splices and mounting hardware.
   f. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushions, **as directed**.
7. Transparent-Plastic Chair Rail: Consisting of clear polycarbonate plastic sheet.
   a. Height: 3 inches (75 mm) nominal **OR** 4 inches (100 mm) nominal **OR** As indicated on Drawings, **as directed**.
   b. Mounting: Surface mounted using flat-head countersunk screws through factory-drilled mounting holes.
8. Rub Strip: Consisting of minimum 0.040-inch- (1.0-mm-) **OR** 0.060-inch- (1.5-mm-), **as directed**, thick, plastic sheet wall-covering material.
   a. Height: 8 inches (200 mm) nominal.
   b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   c. Mounting: Surface mounted with adhesive or double-faced adhesive tape.

C. Handrails
1. Impact-Resistant Plastic Handrails: Assembly consisting of snap-on plastic cover installed over continuous retainer.

a. Cover: Minimum 0.078-inch- (2.0-mm-) **OR** 0.100-inch- (2.5-mm-), **as directed**, thick, extruded rigid plastic; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
   1) Single Handrail: Cylindrical tube profile cover with continuous retainer; with mounting brackets supporting bottom of rail.
      a) Tube Diameter: as directed by the Owner.
   2) Bumper Rail: Cover with flat **OR** sculpted with contoured thumb recess on, **as directed**, front side; with 1-1/2-inch- (38-mm-) diameter gripping surface and finger recess on back side; supported by concealed, continuous retainer and extended mounting brackets.
      a) Bumper-Rail Dimensions: Nominal 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** 5-1/2 inches high by 2 inches deep (140 mm high by 50 mm deep), **as directed**.
      b) Bumper Surface: Smooth **OR** Smooth with coextruded accent inlay strip in contrasting color **OR** Grooved, **as directed**.
      c) Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
   3) Double Handrail with Bumper-Rail Profile: Two tubes mounted above and below nominal, flat-faced bumper rail; each tube with 1-1/2-inch- (38-mm-) diameter gripping surface and finger recess on back side; supported by concealed, continuous retainer and extended mounting brackets.
      a) Bumper-Rail Dimensions: Nominal 4 inches high by 1-1/2 inches deep (100 mm high by 38 mm deep).
      b) Bumper Surface: Smooth **OR** Smooth with coextruded accent inlay strip in contrasting color **OR** Grooved, **as directed**.
      c) Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
   4) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
b. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
c. Mounting Bracket: Extended mounting on injection-molded plastic **OR** anodized-aluminum, **as directed**, mounting brackets.
d. End Caps and Corners: Prefabricated, injection-molded plastic; matching color **OR** contrasting with color, **as directed**, cover; field adjustable for close alignment with snap-on cover.
e. Accessories: Concealed splices, cushions, and mounting hardware.

2. Combination Wood-Plastic Bumper Handrail: Assembly consisting of solid-wood handrail mounted above plastic bumper rail, both mounted on continuous retainer; with reveal between handrail and bumper serving as thumb recess on front side; with 1-1/2-inch- (38-mm-) diameter gripping surface and finger recess on back side.
   a. Wood Handrail: 1-1/2 inches (38 mm) in diameter; with matching end caps and corners.
      1) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech, **as directed**.
      2) Finish: Clear **OR** Stained, **as directed**.
      3) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Bumper: Extruded rigid plastic, minimum 0.078-inch- (2.0-mm-) **OR** 0.100-inch- (2.5-mm-), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Flat **OR** Convex, **as directed**, profile, nominal 4 inches high by 1 inch deep (100 mm high by 25 mm deep).
      2) Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
      3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
      4) End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.
   c. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
   d. Reveal: Extruded rigid plastic or vinyl over aluminum retainer.

1) Color: Brass **OR** Chrome **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

e. Accessories: Concealed splices, cushion(s), and mounting hardware.

3. Wood Handrail with Bumper: Assembly consisting of continuous sculpted, solid-wood handrail, with bumper insert installed in continuous retainer recessed into the face of the wood.
   a. Wood Handrail: As indicated on Drawings with 1-1/2-inch- (38-mm-) diameter gripping surface.
      1) End Caps, Returns, Corners, and Mounting Brackets: Solid wood that matches rail.
      2) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech **OR** Bamboo, **as directed**.
      3) Finish: Clear **OR** Stained, **as directed**.
      4) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Bumper: Extruded rigid plastic **OR** flexible vinyl, **as directed**, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Half-round profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep) **OR** Small rounded profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep), **as directed**.
      2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
      3) End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.
   c. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
      1) Finish: Mill **OR** Brass colored, **as directed**.
   d. Accessories: Concealed splices and mounting hardware.
4. Solid-Wood Handrail: Assembly consisting of continuous sculpted, solid-wood handrail.
   a. Handrail: 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** As indicated on Drawings, **as directed**, with 1-1/2-inch- (38-mm-) diameter gripping surface.
      1) End Caps, Returns, Corners, and Mounting Brackets: Solid wood that matches rail.
      2) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech, **as directed**.
      3) Finish: Clear **OR** Stained, **as directed**.
      4) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

D. Bed Locators
1. Bed Locators: Assembly consisting of continuous snap-on plastic cover installed over continuous retainer; with two bed-locator end caps and mounting hardware; cover designed to spring back when hit.
   a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness.
      1) Profile: Large rounded angled **OR** bullnose, **as directed**, profile, nominal 4 inches high by 2 inches deep (100 mm high by 50 mm deep).
      2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
   b. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
   c. Bed-Locator End Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
   d. Mounting Type: Surface mounted on 1/2-inch- (13-mm-) thick cushion spacers **OR** Extended mounting on injection-molded plastic mounting brackets **OR** Extended mounting on aluminum mounting brackets, **as directed**.

E. Corner Guards
1. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
   1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.
   2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
   3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum **OR** One-piece extruded plastic, **as directed**.
   OR
   Retainer Clips: Manufacturer's standard impact-absorbing clips.

c. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2. Flush-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface, installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.

a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
   1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.
   2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
   3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
   OR
   Retainer Clips: Manufacturer's standard impact-absorbing clips.

c. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.

3. Fire-Rated, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface, installed over continuous retainer and intumescent fire barrier; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.

a. Fire Rating: 1 hour **OR** 2 hours **OR** Same rating as wall in which corner guard is installed, **as directed**; UL listed and labeled according to UL 2079.

b. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
   1) Leg: Nominal 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
   2) Corner Radius: 1/4 inch (6 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
   3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

c. Retainer: Minimum 0.070-inch- (1.8-mm-) thick, one-piece, extruded aluminum.

d. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.

4. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated from PVC plastic, acrylic-modified vinyl sheet or opaque polycarbonate sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.

a. Wing Size: Nominal 3/4 by 3/4 inch (20 by 20 mm) **OR** 1-1/8 by 1-1/8 inches (30 by 30 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm), **as directed**.

b. Mounting: Countersunk screws through factory-drilled mounting holes **OR** Adhesive **OR** Double-faced adhesive foam tape, **as directed**.

c. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

5. Surface-Mounted, Transparent-Plastic Corner Guards: Fabricated from clear polycarbonate plastic sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
   a. Wing Size: Nominal 3/4 by 3/4 inch (20 by 20 mm) **OR** 1-1/8 by 1-1/8 inches (30 by 30 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm), **as directed**.
   b. Thickness: Minimum 0.050 inch (1.3 mm) **OR** 0.075 inch (1.9 mm) **OR** 0.100 inch (2.5 mm), **as directed**.
   c. Mounting: Countersunk screws through factory-drilled mounting holes **OR** Corner clips, **as directed**.
6. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
   a. Material: Stainless steel, Type 304 **OR** Type 430, **as directed**.
      1) Thickness: Minimum 0.0500 inch (1.3 mm) **OR** 0.0625 inch (1.6 mm) **OR** 0.0781 inch (2.0 mm), **as directed**.
      2) Finish: Directional satin, No. 4 **OR** Bright annealed, **as directed**.

      OR

      Material: Extruded aluminum, minimum 0.0625 inch (1.6 mm) thick, with clear anodic finish.

      OR

      Material: Brass sheet, minimum 0.0500 inch (1.3 mm) thick, with buffed, smooth specular **OR** fine satin, **as directed**, finish.
   b. Wing Size: Nominal 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm) **OR** 3-1/2 by 3-1/2 inches (90 by 90 mm), **as directed**.
   c. Corner Radius: 1/8 inch (3 mm) **OR** 3/4 inch (19 mm), **as directed**.
   d. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes **OR** Oval head, countersunk screws through factory-drilled mounting holes **OR** Double-faced, adhesive foam tape **OR** Adhesive, **as directed**.

F. End-Wall Guards
1. Surface-Mounted, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover installed over continuous retainer **OR** continuous retainer at each corner, with end of wall covered by semirigid, impact-resistant sheet wall covering, **as directed**; including mounting hardware.
   a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.
      2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
      3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **a directed**.
   b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
   c. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
2. Flush-Mounted, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface and that covers entire end of wall, installed over continuous retainer **OR** continuous retainer at each corner, with end of wall covered by semirigid, impact-resistant sheet wall covering, **as directed**; including mounting hardware.
   a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
      1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.

2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
c. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.

3. Fire-Rated, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface and that covers entire end of wall, installed over continuous retainer and intumescent fire barrier; including mounting hardware; full wall height.
a. Fire Rating: 1 hour **OR** 2 hours **OR** Same rating as wall in which end guard is installed, **as directed**; UL listed and labeled according to UL 2079.
b. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
1) Leg: Nominal 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
2) Corner Radius: 1/4 inch (6 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Retainer: Minimum 0.070-inch- (1.8-mm-) thick, one-piece, extruded aluminum.
d. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.

4. Surface-Mounted, Metal, End-Wall Guards: Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.
a. Material: Stainless steel, Type 304 **OR** Type 430 **as directed**.
1) Thickness: Minimum 0.0500 inch (1.3 mm) **OR** 0.0625 inch (1.6 mm) **OR** 0.0781 inch (2.0 mm), **as directed**.
2) Finish: Directional satin, No. 4 **OR** Bright annealed, **as directed**.
OR
Material: Extruded aluminum, minimum 0.0625 inch (1.6 mm) thick, with clear anodic finish.
OR
Material: Brass sheet, minimum 0.0500 inch (1.3 mm) thick, with buffed, smooth specular **OR** fine satin, **as directed**, finish.
b. Wing Size: Nominal 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm) **OR** 3-1/2 by 3-1/2 inches (90 by 90 mm), **as directed**.
c. Corner Radius: 1/8 inch (3 mm) **OR** 3/4 inch (19 mm), **as directed**.
d. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes **OR** Oval head, countersunk screws through factory-drilled mounting holes **OR** Double-faced, adhesive foam tape **OR** Adhesive, **as directed**.

G. Impact-Resistant Wall Coverings
1. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
a. Size: 48 by 96 inches (1219 by 2438 mm) for sheet **OR** 48 by 120 inches (1219 by 3048 mm) for roll **OR** As indicated, **as directed**.
b. Sheet Thickness: 0.022 inch (0.56 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.040 inch (1.0 mm) **OR** 0.060 inch (1.5 mm) **OR** 0.080 inch (2.0 mm) **OR** 0.093 inch (2.4 mm) **OR** 0.125 inch (3.0 mm), **as directed**.
c. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
d. Height: Full wall **OR** Wainscot **OR** As indicated, **as directed**.
e. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
f. Mounting: Adhesive.
2. Prelaminated, Impact-Resistant Wall Panels: Rigid wall panels consisting of impact-resistant plastic sheet wall covering material factory laminated to high-impact-resistant core, with moisture-resistant vapor barrier factory laminated to reverse side of panel for stability.

a. Composition: 0.028-inch- (0.70-mm-) thick plastic sheet laminated to 3/8-inch- (9.5-mm-) thick, particleboard core **OR** 0.04-inch- (1.02-mm-) thick plastic sheet laminated to 3/8-inch- (9.5-mm-) thick, particleboard core, **as directed**.
b. Sheet Size: 48 by 96 inches (1219 by 2438 mm) **OR** 48 by 108 inches (1219 by 2743 mm) **OR** 48 by 120 inches (1219 by 3048 mm) **OR** As indicated, **as directed**.
c. Height: Full wall **OR** Wainscot **OR** As indicated, **as directed**.
d. Sheet Edge: Square **OR** Beveled, **as directed**.
e. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
f. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
g. Mounting: Adhesive.

H. Door Protection Systems
1. General: Comply with BHMA A156.6.
a. For fire-rated doors, provide door protection systems that are UL listed and labeled.
2. Protection Plates: Fabricated from extruded rigid plastic, of thickness indicated.
3. Full-Height Door-Surface Protection: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; with 90-degree bend for door-edge protection.
a. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
b. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
4. Armor Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.
a. Size: 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm) **OR** 42 inches (1067 mm), **as directed**, high by door width, with allowance for frame stops.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
5. Kick Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed** wall thickness; beveled four sides.
a. Size: 8 inches (203 mm) **OR** 10 inches (254 mm) **OR** 12 inches (305 mm), **as directed**, high by door width, with allowance for frame stops.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
6. Mop Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.
a. Size: 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**, high by 1 inch (25 mm) less than door width.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
7. Stretcher Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.
a. Size: 6 inches (152 mm) **OR** 8 inches (203 mm), **as directed**, high by door width, with allowance for frame stops.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
8. Push Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.

a. Size: 12 inches high by 4 inches wide (305 mm high by 102 mm wide) **OR** 16 inches high by 4 inches wide (406 mm high by 102 mm wide), **as directed**.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.

9. Door-Edge Protection: Fabricated from extruded rigid plastic, minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm), **as directed**, wall thickness; formed to fit over door edge without mortising.
a. Shape: L **OR** U, **as directed**.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.

10. Door-Frame Protector: Fabricated from extruded rigid plastic, minimum 0.040-inch (1.0-mm) **OR** 0.050-inch (1.3-mm) **OR** 0.060-inch (1.5-mm), **as directed**, wall thickness; formed to fit entire door-frame profile.
a. Height: 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.

11. Door-Frame Protector: Assembly consisting of snap-on plastic cover installed over continuous retainer; formed to fit door frame on opposite side of door swing.
a. Cover: Extruded rigid plastic, minimum 0.080-inch (2.0-mm) wall thickness; in dimensions and profiles indicated.
1) Height: 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
2) Corner Radius: 1/4 inch (6 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
b. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.

12. Door-Knob **OR** Door-Lever, **as directed**, Protector: Fabricated from injection-molded plastic, minimum 0.060-inch (1.5-mm) wall thickness.
a. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
b. Mounting: Countersunk screws through factory-drilled mounting holes.

I. Fabrication
1. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
2. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:
a. Sheet Thickness of 0.040 Inch (1.0 mm): 24-inch (610-mm) radius.
b. Sheet Thickness of 0.060 Inch (1.5 mm): 36-inch (914-mm) radius.
3. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
4. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
5. Miter corners and ends of wood handrails for returns.

J. Metal Finishes
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
a. Remove tool and die marks and stretch lines, or blend into finish.
b. Grind and polish surfaces to produce uniform finish, free of cross scratches.

c. Run grain of directional finishes with long dimension of each piece.
d. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.3 EXECUTION

A. Examination
1. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
2. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
a. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation
1. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
2. Before installation, clean substrate to remove dust, debris, and loose particles.

C. Installation
1. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
a. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated on Drawings **OR** as directed.
b. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
1) Provide anchoring devices to withstand imposed loads.
2) Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
3) Adjust end and top caps as required to ensure tight seams.
2. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

D. Cleaning
1. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
2. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

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Task	Specification	Specification Description
10 26 13 00	05 50 00 00	Metal Fabrications
10 26 23 13	10 26 13 00	Impact-Resistant Wall Protection

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SECTION 10 28 13 13 - TOILET AND BATH ACCESSORIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for toilet and bath accessories. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following:
   a. Public-use washroom accessories.
   b. Public-use shower room accessories.
   c. Private-use bathroom accessories.
   d. Healthcare accessories.
   e. Warm-air dryers.
   f. Childcare accessories.
   g. Underlavatory guards.
   h. Custodial accessories.

C. Submittals
1. Product Data: For each type of product indicated.
2. Product Schedule:
   a. Identify locations using room designations indicated on Drawings.
   b. Identify products using designations indicated on Drawings.

D. Warranty
1. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within 15 years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
2. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
3. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
5. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
6. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
7. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
8. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
9. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

B. Public-Use Washroom Accessories
1. Toilet Tissue (Roll) Dispenser:

a. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset **OR** Single-roll dispenser **OR** Double-roll dispenser **OR** Double-roll dispenser with shelf, **as directed**.
b. Mounting: Recessed **OR** Partition mounted serving two adjacent toilet compartments **OR** Surface mounted, **as directed**.
c. Operation: Noncontrol delivery with standard spindle **OR** Noncontrol delivery with theft-resistant spindle **OR** Spindleless with tension-spring controlled delivery **OR** Spindleless with tension-spring controlled delivery and self-locking device extending through core that prevents core removal until roll is empty **OR** Eccentric-shaped, molded-plastic spindle revolves one-half revolution per dispensing operation for controlled delivery; core cannot be removed until roll is empty, **as directed**.
d. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) **OR** 5-inch- (127-mm-), **as directed,** diameter tissue rolls.
e. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Chrome-plated zinc alloy (zamac) or steel **OR** Satin-finish aluminum bracket with plastic spindle **OR** ABS plastic, gray, **as directed**.

2. Combination Toilet Tissue Dispenser:
a. Description: Combination unit with double-roll toilet tissue dispenser and the following:
1) Removable sanitary-napkin waste receptacle with self-closing disposal-opening cover.
2) Seat-cover dispenser with minimum capacity of 500 **OR** 1000, **as directed,** single or half-fold seat covers.
b. Mounting: Recessed **OR** Surface mounted **OR** Partition mounted, dual access with two tissue rolls per compartment **OR** Partition mounted, dual access with two tissue rolls per compartment and with one side that mounts flush with partition of accessible compartment, **as directed**.
c. Toilet Tissue Dispenser Capacity: 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
d. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
e. Material and Finish: Stainless steel, No. 4 finish (satin).
f. Lockset: Tumbler type.

3. Toilet Tissue (Folded) Dispenser:
a. Description: Folded-tissue dispenser with cover hinged at bottom.
b. Mounting: Surface mounted.
c. Minimum Capacity: 1250 single-fold tissues.
d. Material and Finish: Stainless steel, No. 4 finish (satin).
e. Lockset: Tumbler type.
f. Refill Indicators: Pierced slots at front.

4. Toilet Tissue (Jumbo-Roll) Dispenser:
a. Description: One-roll unit **OR** Two-roll unit with sliding panel to expose other roll, **as directed**.
b. Mounting: Surface mounted.
c. Capacity: 9- or 10-inch- (228- or 254-mm-) diameter rolls.
d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
e. Lockset: Tumbler type.
f. Refill Indicator: Pierced slots at front.

5. Paper Towel (Folded) Dispenser:
a. Mounting: Recessed **OR** Semirecessed **OR** Deck mounted, recessed **OR** Surface mounted, **as directed**.
b. Minimum Capacity: 400 C-fold or 525 multifold towels **OR** 600 C-fold or 800 multifold towels **OR** 400 single-fold towels, **as directed**.
c. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
d. Lockset: Tumbler type.
e. Refill Indicators: Pierced slots at sides or front.

6. Paper Towel (Roll) Dispenser:

a. Description: Lever-actuated mechanism permits controlled delivery of paper rolls in preset lengths per stroke.
b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
c. Minimum Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
e. Lockset: Tumbler type.

7. Waste Receptacle:
   a. Mounting: Open top, recessed **OR** Self-closing disposal-opening cover, recessed **OR** Semirecessed **OR** Surface mounted **OR** Wall mounted for corner installation **OR** Freestanding **OR** Undercounter, **as directed**.
   b. Minimum Capacity: Capacity in gal. (L) **as directed**.
   c. Material and Finish: Stainless steel, No. 4 finish (satin).
   d. Liner: Reusable vinyl liner.
   e. Lockset: Tumbler type for waste-receptacle.
8. Combination Towel (Folded) Dispenser/Waste Receptacle:
   a. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
   b. Mounting: Surface mounted **OR** Surface mounted with stainless-steel collar **OR** Recessed **OR** Recessed with projecting receptacle **OR** Semirecessed, **as directed**.
      1) Designed for nominal 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed,** wall depth.
   c. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
   d. Minimum Waste-Receptacle Capacity: 4 gal. (15 L) **OR** 12 gal. (45.4 L), **as directed.**
   e. Material and Finish: Stainless steel, No. 4 finish (satin).
   f. Liner: Reusable, vinyl waste-receptacle liner.
   g. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
9. Combination Towel (Roll) Dispenser/Waste Receptacle:
   a. Description: Combination unit for dispensing preset length of roll paper towels, with removable waste receptacle.
   b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
   c. Minimum Towel-Dispenser Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
   d. Minimum Waste Receptacle Capacity: 8 gal. (30 L) **OR** 12 gal. (45.4 L) **OR** 15 gal. (56.8 L), **as directed**.
   e. Material and Finish: Stainless steel, No. 4 finish (satin).
   f. Liner: Reusable, vinyl waste-receptacle liner.
   g. Lockset: Tumbler type for towel dispenser compartment and waste receptacle.
10. Multipurpose Soap/Towel Dispenser Unit:
    a. Description: Combination unit for dispensing soap in liquid or lotion **OR** lather, **as directed,** form and folded towels.
    b. Mounting: Recessed, designed for nominal 4-inch (100-mm) wall depth **OR** Surface mounted with stainless-steel collar, **as directed**.
    c. Minimum Soap-Dispenser Capacity: 80 oz. (2.36 L).
    d. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold **OR** 1000 single-fold, **as directed,** towels.
    e. Material and Finish: Stainless steel, No. 4 finish (satin) for unit body and soap valve.
    f. Lockset: Tumbler type.
11. Liquid-Soap Dispenser:
    a. Description: Designed for dispensing soap in liquid or lotion **OR** lather, **as directed,** form.
    b. Mounting: Deck mounted on vanity **OR** Deck mounted on lavatory **OR** Horizontally oriented, recessed **OR** Horizontally oriented, surface mounted **OR** Vertically oriented, surface mounted, **as directed**.
    c. Capacity: Capacity in **oz. (mL), as directed.**
    d. Materials: Valve and reservoir materials and finishes, **as directed**.
    e. Lockset: Tumbler type.
    f. Refill Indicator: Window type.
12. Grab Bar:

a. Mounting: Flanges with concealed **OR** exposed, **as directed,** fasteners.
b. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
1) Finish: Smooth, No. 4, satin finish **OR** Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area, **as directed**.
c. Outside Diameter: 1-1/4 inches (32 mm) **OR** [1-1/2 inches (38 mm), **as directed**.
d. Configuration and Length: As indicated on Drawings **OR** Straight, 36 inches (914 mm) long, **as directed**.

13. Vendor:
a. Type: Sanitary napkin **OR** Sanitary napkin and tampon **OR** Condom, **as directed**.
b. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth, **OR** Semirecessed, **OR** Surface mounted, **as directed**.
c. Capacity: **As directed**.
d. Operation: No coin (free) **OR** Single coin (25 cents) **OR** Two coin (50 cents), **as directed**.
e. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
f. Lockset: Tumbler type with separate lock and key for coin box.

14. Sanitary-Napkin Disposal Unit:
a. Mounting: Recessed **OR** Partition mounted, dual access **OR** Surface mounted, **as directed**.
b. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
c. Receptacle: Removable.
d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.

15. Seat-Cover Dispenser:
a. Mounting: Surface mounted **OR** Recessed **OR** Partition mounted, dual access, **as directed**.
b. Minimum Capacity: 250 **OR** 500, **as directed,** seat covers.
c. Exposed Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
d. Lockset: Tumbler type.

16. Fold-Down Purse Shelf:
a. Description: Hinged unit with spring-loaded shelf that automatically returns to vertical position.
b. Nominal Size: 15 inches (381 mm) long by 5-1/2 inches (140 mm) wide.
c. Material and Finish: Chrome-plated cast-zinc alloy (zamac) with stippled finish on tray or stainless steel, No. 4 finish (satin) **OR** Chrome-plated cast-zinc alloy (zamac) with stippled finish on tray and bright chrome finish on edges **OR** Stainless steel, No. 4 finish (satin), **as directed**.

17. Mirror Unit:
a. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick **OR** Stainless-steel channel **OR** Stainless steel, fixed tilt **OR** Stainless steel, adjustable tilt, **as directed**.
1) Corners: Manufacturer's standard **OR** Mitered and mechanically interlocked **OR** Welded and ground smooth, **as directed**.
b. Integral Shelf: 5 inches (127 mm) deep.
c. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
1) One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2) Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
d. Size: As indicated on Drawings **OR as directed**.

18. Facial Tissue Dispenser:
a. Mounting: Wall mounted, recessed **OR** Surface mounted, **as directed**.
b. Nominal Depth: 2-1/4 inches (57 mm) **OR** 4 inches (102 mm), **as directed**.
c. Capacity: 150 double-ply tissues.
d. Material and Finish:

1) Dispenser Face: Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
2) Cabinet: Steel with corrosion-resistant finish.

C. Public-Use Shower Room Accessories
1. Shower Curtain Rod:
a. Description: 1-inch (25.4-mm) OD; fabricated from nominal 0.0375-inch- (0.95-mm-) thick stainless steel **OR** 1-1/4-inch (32-mm) OD; fabricated from nominal **0.05-inch- (1.3-mm-) thick stainless steel, as directed.**
b. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
c. Finish: No. 4 (satin).
2. Shower Curtain:
a. Size: Minimum 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed,** wider than opening by 72 inches (1828 mm) high.
b. Material: Vinyl, minimum 0.006-inch- (0.15-mm-) thick, opaque, matte, **OR** Duck, minimum 8 oz. (227 g), white, 100 percent cotton, **OR** Nylon-reinforced vinyl, minimum 10-oz. (284-g) or 0.008-inch- (0.2-mm-) thick vinyl, with integral antibacterial agent, **as directed**.
c. Color: White **OR** Green **OR** As selected from manufacturer's full range, **as directed**.
d. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
e. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
3. Folding Shower Seat:
a. Configuration: L-shaped seat, designed for wheelchair access **OR** Rectangular seat **OR** Triangular, corner-type seat **OR** Stainless-steel seat designed to fold into recessed-mounted, stainless-steel wall box, **as directed**.
b. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected **OR** White vinyl padded seat **OR** Stainless steel, No. 4 finish (satin); 0.05-inch (1.3-mm) minimum nominal thickness; with single-piece, pan-type construction and edge seams welded and ground smooth, **as directed**.
c. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
d. Dimensions: **As directed.**
4. Soap Dish:
a. Description: With **OR** Without, **as directed,** washcloth bar.
b. Mounting: Recessed **OR** Surface mounted, **as directed**.
c. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Ceramic at Cermaic Tile Bathtub surround (See Ceramic Tile Section) **OR** Metal at Porcelain Steel Bathtub Surround (Fastenings: Plated expansion toggle or molly bolts, lead anchors or as required by existing wall conditions), **as directed**.

D. Private-Use Bathroom Accessories
1. Toilet Tissue Dispenser:
a. Description: Single-roll dispenser **OR** Double-roll dispenser **OR** Single-roll dispenser with hood **OR** Double-roll dispenser with hood, **as directed**.
b. Mounting: Recessed **OR** Surface mounted, **as directed**.
c. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
d. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
2. Shower Curtain Rod:
a. Outside Diameter: 1 inch (25.4 mm) **OR** 1-1/4 inch (32 mm), **as directed**.
b. Mounting: Flanges with exposed **OR** concealed, **as directed,** fasteners.
c. Rod Material and Finish: Solid brass, polished **OR** Polished chrome-plated brass **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.

d. Flange Material and Finish: Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
e. Accessories: Integral chrome-plated brass glide hooks.

3. Soap Dish:
   a. Description: **As directed**.
   b. Mounting: Recessed **OR** Surface mounted, **as directed**.
   c. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished) **OR** Ceramic at Cermaic Tile Bathtub surround (See Ceramic Tile Section) **OR** Metal at Porcelain Steel Bathtub Surround (Fastenings: Plated expansion toggle or molly bolts, lead anchors or as required by existing wall conditions), **as directed**.
4. Medicine Cabinet:
   a. Mounting: Recessed, for nominal 4-inch (100-mm) wall depth **OR** Surface mounted, **as directed**.
   b. Size: 18 by 24 inches (460 by 610 mm).
   c. Door: Framed mirror door concealing storage cabinet equipped with continuous hinge and spring-buffered, rod-type stop and magnetic door catch.
   d. Shelves: Three, adjustable.
   e. Material and Finish:
      1) Cabinet: Stainless steel, No. 4 finish (satin) **OR** Steel with corrosion resistant finish, **as directed**.
      2) Mirror Frame: **As directed.**
      3) Door: **As directed.**
      4) Hinge: **As directed.**
      5) Shelves: **As directed.**
5. Facial Tissue Dispenser:
   a. Mounting: Wall mounted, recessed **OR** Surface mounted, **as directed**.
   b. Depth: 2-5/8 inches (67 mm) **OR** 4 inches (102 mm), **as directed**.
   c. Material and Finish:
      1) Dispenser Face: Polished chrome-plated brass **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated steel **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
      2) Cabinet: Steel with corrosion-resistant finish.
6. Robe Hook:
   a. Description: Double-prong **OR** Single-prong, **as directed,** unit.
   b. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
7. Toothbrush and Tumbler Holder:
   a. Description: **As directed**.
   b. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
8. Towel Bar:
   a. Description: 3/4-inch- (19-mm-) square tube with rectangular end brackets **OR** 3/4-inch- (19-mm-) round tube with circular end brackets, **as directed**.
   b. Mounting: Flanges with concealed **OR** exposed, **as directed,** fasteners.
   c. Length: 18 inches (457 mm), **OR** 24 inches (610 mm), **OR** 30 inches (762 mm), **as directed**.
   d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished) **OR** Polished aluminum, **as directed**.
9. Towel Pin:

a. Description: Projecting minimum of 3 inches (75 mm) **OR** 5 inches (127 mm), **as directed,** from wall surface.
b. Material and Finish: Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.

10. Towel Ring:
a. Description: Pin projecting approximately 2-1/2 inches (63 mm) from wall with square **OR** circular **OR** oval **OR** trapezoidal, **as directed,** ring.
b. Pin Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
c. Ring Material and Finish: Matching pin **OR** Clear plastic, **as directed**.

11. Towel Shelf:
a. Description: Surface-mounted, guest-towel shelf with four 3/8-inch- (9-mm-) diameter **OR** 5/16-inch- (8-mm-) square, **as directed,** stainless steel tubes mounted in support arms.
1) Towel Bar: 1/4-inch (6-mm-) diameter **OR** 5/16-inch- (8-mm-) square, **as directed,** stainless-steel towel bar below shelf.
b. Length: 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed.**
c. Material and Finish: Polished brass-plated stainless steel tubes mounted in zinc alloy (zamac) support arms **OR** Polished chrome-plated stainless steel tubes mounted in zinc alloy (zamac) support arms **OR** Stainless steel, No. 7 finish (polished), **as directed**.

12. Towel Rack:
a. Description: Surface-mounted, guest-towel unit with approximately 1/4-inch- (6-mm-) diameter wire rings welded to upright wire bracket.
b. Capacity: 2 **OR** 3 **OR** 4, **as directed,** sets of bath towels, hand towels, and washcloths.
c. Nominal Height: 11 inches (279 mm) **OR** 17 inches (432 mm) **OR** 21 inches (533 mm), **as directed**.
d. Material and Finish: Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated zinc alloy (zamac), **as directed**.

13. Retractable Clothesline:
a. Description: Surface-mounted rectangular **OR** circular, **as directed,** housing with minimum 72-inch- (1829-mm-) long, retractable, spring-actuated, synthetic clothesline and remote retention bracket.
b. Material and Finish Chrome-plated brass **OR** Stainless steel, No. 7 finish (polished), **as directed**.

14. Bottle Opener:
a. Description: Surface-mounted unit with standard **OR** vandal-resistant, **as directed,** fasteners.
b. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished) **OR** Chrome-plated steel, **as directed**.

E. Healthcare Accessories

1. Specimen Pass-Through Cabinet:
a. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at the same time, and removable stainless-steel tray.
b. Nominal Wall Opening: 12 by 11-1/4 inches (305 by 285 mm), width times height.
c. Material and Finish: Stainless steel, No. 4 finish (satin).

2. Specimen Pass-Through Box:
a. Description: With minimum 12-inch (305-mm) diameter turntable removable cylinder that revolves on stainless-steel self-lubricating ball bearing plates, and with mechanism to prevent over rotation of cylinder.
b. Nominal Wall Opening: 13-1/4 by 14 inches (335 by 355 mm), width times height.
c. Material and Finish: Stainless steel, No. 4 finish (satin).
d. Lockset: Tumbler type.

3. Bedpan and Urinal Cabinet:

a. Description: For storing one conventional size bedpan and one urinal bottle; with door that produces 1/2-inch (13-mm) opening at top and bottom of cabinet to allow air circulation.
b. Mounting: Recessed.
c. Nominal Wall Opening: 13-1/2 by 26-1/2 by 5 inches (340 by 670 by 130 mm), width times height times depth.
d. Material and Finish: Stainless steel, No. 4 finish (satin).

4. Bedpan and Urinal Rack:
a. Description: For storing one conventional size bedpan and one urinal bottle.
b. Mounting: Surface mounted.
c. Size: 12 by 27 inches (300 by 685 mm), width times height.
d. Material and Finish: Stainless steel, No. 4 finish (satin).

F. Warm-Air Dryers
1. Warm-Air Dryer:
a. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
b. Operation: Touch-button **OR** Electronic-sensor, **as directed,** activated with timed power cut-off switch.
1) Operation Time: 30 to 40, **OR** 80, **as directed,** seconds.
c. Cover Material and Finish: Steel, with white enamel finish **OR** Cast iron, with enamel finish in color selected **OR** Chrome-plated steel **OR** Stainless steel, No. 4 finish (satin) **OR** Molded plastic, gray **OR** Molded plastic, white, **as directed**.
d. Electrical Requirements: 115 V, 13 A, 1500 W **OR** 115 V, 15 A, 1725 W **OR** 115 V, 20 A, 2300 W **OR** 208-240 V, 9-10 A, 1900-2300 W, **as directed**.

G. Childcare Accessories
1. Diaper-Changing Station:
a. Description: Horizontal **OR** Vertical, **as directed,** unit that opens by folding down from stored position and with child-protection strap.
1) Engineered to support a minimum of 250-lb (113-kg) static load when opened.
b. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed **OR** Semirecessed, with unit projecting not more than 1 inch (25 mm) from wall when closed, **as directed**.
c. Operation: By pneumatic shock-absorbing mechanism.
d. Material and Finish: High-density polyethylene in manufacturer's standard color **OR** High-density polyethylene with plastic laminate insert in color selected **OR** Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners **OR** Stainless steel, No. 4 finish (satin), exterior shell with rounded plastic corners; high-density polyethylene interior in manufacturer's standard color, **as directed**.
e. Liner Dispenser: Built in.
2. Diaper-Pack Vendor:
a. Mounting: Surface mounted **OR** Recessed, **as directed**.
b. Minimum Capacity: 100 diaper packs.
c. Coin Operation: Coin slot preset for 1 U.S. dollar, adjustable up in 25-cent increments.
d. Material and Finish: Stainless steel, No. 4 finish (satin).
3. Child-Protection Seat:
a. Description: Unit that opens by folding down from stored position and with child-protection strap.
1) Engineered to support a minimum of 80-lb (36-kg), **OR** 150-lb (68-kg), **as directed,** static load when opened.
b. Mounting: Surface mounted, with unit projecting not more than 4-1/2 inches (114 mm), **OR** 6 inches (152 mm), **as directed,** from wall when closed.
c. Material and Finish: High-density polyethylene in manufacturer's standard color.

H. Underlavatory Guards
1. Material and Finish: Antimicrobial, molded-plastic, white.

I. Custodial Accessories
1. Utility Shelf:
a. Description: With exposed edges turned down not less than 1/2 inch (12.7 mm) and supported by two triangular brackets welded to shelf underside.
b. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
c. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).
2. Mop and Broom Holder:
a. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
b. Length: 36 inches (914 mm).
c. Hooks: Three.
d. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
e. Material and Finish: Stainless steel, No. 4 finish (satin).
1) Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
2) Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.
3. Paper Towel (Folded) Dispenser:
a. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
b. Minimum Capacity: 400 C-fold or 525 multifold towels **OR** 600 C-fold or 800 multifold towels **OR** 400 single-fold towels, **as directed**.
c. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
d. Lockset: Tumbler type.
e. Refill Indicators: Pierced slots at sides or front.
4. Paper Towel (Roll) Dispenser:
a. Description: Lever-actuated mechanism permits controlled delivery of paper rolls in preset lengths per stroke.
b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
c. Minimum Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
d. Material and Finish: Stainless steel, No. 4 finish (satin), **OR** ABS plastic, gray, **as directed**.
e. Lockset: Tumbler type.
5. Liquid-Soap Dispenser:
a. Description: Designed for dispensing soap in liquid or lotion **OR** lather, **as directed,** form.
b. Mounting: Deck mounted on vanity **OR** Deck mounted on lavatory **OR** Horizontally oriented, recessed **OR** Horizontally oriented, surface mounted **OR** Vertically oriented, surface mounted, **as directed**.
c. Capacity: Capacity in oz. (mL), **as directed.**
d. Materials: Valve and reservoir materials and finishes, **as directed**.
e. Lockset: Tumbler type.
f. Refill Indicator: Window type.

J. Fabrication
1. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

1.3 EXECUTION

A. Installation
a. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
b. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

END OF SECTION 10 28 13 13

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SECTION 10 28 13 13a - DETENTION TOILET ACCESSORIES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for detention toilet accessories. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. Section Includes:
a. Safety hooks.
b. Shelves.
c. Combination shelves with safety hooks.
d. Miscellaneous toilet accessories.
e. Stainless-steel mirrors.
f. Grab bars.
g. Shower seats.

C. Submittals
1. Product Data: For each type of product indicated.
2. LEED Submittals:
a. Product Data for Credit EQ 4.1: For security sealants, including printed statement of VOC content.
3. Samples: For each type of detention toilet accessory indicated.
4. Product Schedule: Indicate types, quantities, sizes, and installation locations by room.
5. Coordination Drawings: Drawings showing location of each built-in anchor supporting detention toilet accessories, including anchors to be installed as work of other Sections, drawn to scale and coordinating anchorage with detention toilet accessories.
6. Welding certificates.
7. Maintenance data.
8. Warranties: Sample of special warranties.
9. Other Informational Submittals:
a. Examination reports documenting inspection of substrates, areas, and conditions.
b. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
c. Field quality-control certification signed by Contractor and Detention Specialist.

D. Quality Assurance
1. Welding Qualifications: Qualify procedures and personnel according to the following:
a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
b. AWS D1.3, "Structural Welding Code - Sheet Steel."
c. AWS D1.6, "Structural Welding Code - Stainless Steel."
2. Preinstallation Conference: Conduct conference at Project site.
3. Coordination Meetings: Conduct coordination meetings at Project site to comply with requirements in Division 01 Section "Special Project Procedures For Detention Facilities".

E. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace detention toilet accessories that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Materials
1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) coating designation.
3. Stainless-Steel Sheet: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304; Type 430 for mirrors.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
5. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
6. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to 4 times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   a. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
7. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter headed studs welded to back of plate.
8. Proprietary Built-in Masonry Anchors: Fabricated from 0.134-inch (3.41-mm) nominal-thickness steel sheet **OR** 1/4-inch (6.3-mm) nominal-thickness steel plate **OR** 1/2-inch (12.7-mm) nominal-thickness steel plate, **as directed**, into 6-inch- (152-mm-) **OR** 8-inch- (203-mm-), **as directed**, deep blocks matching size of concrete masonry units; with weld nuts attached on inside to receive field-bolted attachments, **as directed**.
   a. Finish: Factory primed for field painting for anchors with field-welded attachments **OR** Polyester powder coat for anchors with bolted attachments **OR** Epoxy paint for anchors with bolted attachments, **as directed**.
9. Welding Rods and Bare Electrodes: Select according to AWS specifications.

B. Security Sealants
1. Manufacturer's standard, high-modulus, nonsag, two-part, pick-proof, epoxy sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing nonmoving interior joints in security applications.

C. Security Fasteners
1. Fasteners that are operable only by tools produced by fastener manufacturer or other licensed fabricator for use on specific type of fastener.
2. Provide drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:
   a. Drive-System Types: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
   b. Fastener Strength: 120,000 psi (827 MPa).
   c. Socket Button Head Fasteners:
      1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
      2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
   d. Socket Flat Countersunk Head Fasteners:
      1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
      2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
   e. Socket Head Cap Fasteners:
      1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
      2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
   f. Protective Coatings for Heat-Treated Alloy Steel:
      1) Zinc and clear trivalent chromium, where indicated.
      2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

D. Detention Safety Hooks
1. Individual, Curved, Detention Safety Hook: 0.188-inch (4.77-m) nominal-thickness, stainless-steel curved hook held by 0.141-inch- (3.58-mm-) **OR** 0.109-inch- (2.77-mm-), **as directed**, thick, stainless-steel bracket punched with not less than 2 holes for fastening with security fastener. Provide friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide No. 4 finish.
2. Individual, Straight, Detention Safety Hook: 3/8-inch- (9.5-mm-) **OR** 1/4-inch- (6.3-mm-), **as directed**, diameter, stainless-steel straight hook held by 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel mounting plate approximately 4 inches (102 mm) square. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N). Provide No. 4 finish.
   a. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
3. Multiple, Curved, Safety Hook Strip: Minimum 5-1/2-inch- (140-mm-) high backplate by length indicated, formed from 0.125-inch- (3.18-mm-) **OR** 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet. Provide 0.188-inch- (4.77-mm-) thick, stainless-steel hooks attached to backplate; with each hook having a friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide No. 4 finish.
   a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 21 inches (533 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
   b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
4. Multiple, Straight, Safety Hook Strip: Minimum 5-1/2-inch- (140-mm-) high backplate by length indicated, formed from 0.141-inch- (3.58-mm-) **OR** 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet. Provide 3/8-inch- (9.5-mm-) **OR** 1/4-inch- (6.3-mm-), **as directed**, diameter, stainless-steel straight hooks attached to backplate. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N). Provide No. 4 finish.
   a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
   b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

E. Detention Shelves
1. Surface-Mounted, Steel Detention Shelf: Minimum 6 inches high by 8 inches (152 mm high by 203 mm) deep by 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 32 inches (813 mm), **as directed**, long; formed from 0.138-inch (3.50-mm) **OR** 0.108-inch (2.74-mm), **as directed**, nominal-thickness, metallic-coated steel sheet; with welded side gussets and minimum 1-inch (25.4-mm) flanged front edge; with back punched for fastening to wall with security fasteners. Provide factory priming for field-painted **OR** baked-enamel, **as directed**, finish.
2. Surface-Mounted, Stainless-Steel Detention Shelf: Minimum 5-1/2 inches high by 8 inches (140 mm high by 203 mm) deep by 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**, long; formed from 0.078-inch- (1.98-mm-) thick, stainless-steel sheet; with welded side gussets and hemmed front edge. Provide No. 4 finish.
   a. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
3. Recessed Detention Shelf: Minimum inside dimensions of 16 inches (406 mm) wide by 5 inches high by 4 inches (127 mm high by 102 mm) deep; formed from 0.062-inch- (1.57-mm-) thick, stainless-steel sheet; with 1-inch- (25.4-mm-) wide flanged front edge. Secure to wall with rear-mounting steel strap and adjustment bolts. Provide No. 4 finish.

F. Combination Detention Shelves With Safety Hooks

1. Steel Detention Shelf with Multiple, Curved Safety Hooks: Minimum 6 inches high by 8 inches (152 mm high by 203 mm) deep by length indicated, formed from 0.138-inch (3.50-mm) **OR** 0.108-inch (2.74-mm), **as directed**, nominal-thickness, metallic-coated steel sheet, with welded side gussets and hemmed or flanged front edge. Provide 0.138-inch (3.50-mm) nominal-thickness, zinc-plated-steel curved hooks held by 0.1265-inch- (3.21-mm-) thick steel brackets welded to backplate, with each hook having a friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide factory priming for field-painted **OR** baked-enamel, **as directed**, finish.
   a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
   b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
2. Stainless-Steel Detention Shelf with Multiple, Curved Safety Hooks: Minimum 5-1/2 inches high by 8 inches (140 mm high by 203 mm) deep by length indicated; formed from 0.078-inch- (1.98-mm-) thick, stainless-steel sheet; with welded side gussets and hemmed or flanged front edge. Provide 0.141-inch (3.58-mm) stainless-steel curved hooks held by 0.141-inch- (3.58-mm-) thick stainless-steel brackets welded to backplate, with each hook having a friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide No. 4 finish.
   a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
   b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
3. Stainless-Steel Detention Shelf with Multiple, Straight Safety Hooks: Minimum 5-1/2 inches high by 8 inches (140 mm high by 203 mm) deep by length indicated; formed from 0.078-inch- (1.98-mm-) thick, stainless-steel sheet; with welded side gussets and hemmed or flanged front edge. Provide 3/8-inch- (9.5-mm-) **OR** 1/4-inch- (6.3-mm-), **as directed**, diameter, stainless-steel straight hooks held by 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel mounting plate. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N). Provide No. 4 finish.
   a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
   b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

G. Miscellaneous Detention Toilet Accessories
1. Recessed, Detention Toilet Tissue Dispenser: Minimum 5-inch diameter by 4-1/2 inches (127-mm diameter by 114 mm) deep; formed from 0.062-inch- (1.57-mm-) thick, stainless-steel sheet. Secure to wall with rear-mounting steel strap and adjustment bolts. Provide No. 4 finish.
   a. Face: 1-inch (25.4-mm) lip around entire face **OR** 7-inch- (178-mm-) square face flange, **as directed**.
2. Recessed, Detention Soap Dish: Minimum inside dimensions of 5-3/4 inches wide by 4-1/2 inches high by 2-1/2 inches (146 mm wide by 114 mm high by 64 mm) deep with 3/4-inch (19-mm) lip around entire face; formed from 0.062-inch- (1.57-mm-) **OR** 0.050-inch- (1.27-mm-), **as directed**, thick, stainless-steel sheet. Secure to wall with rear-mounting steel strap and adjustment bolts. Provide No. 4 finish.

H. Detention Mirrors
1. Small, Framed Detention Mirror: Approximately 9-1/2 inches wide by 11 inches (241 mm wide by 279 mm) high; formed from 0.038-inch- (0.95-mm-) thick, stainless-steel sheet with fiberboard backing; enclosed in a frame formed from 0.064-inch (1.63-mm) nominal-thickness, zinc-plated

steel sheet; with round corners. Fabricate frame with welded and ground corners or from one piece of metal. Provide No. 8 **OR** 4, **as directed**, finish for mirror, chrome plating for frame.

a. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

2. Small, Integrally Framed Detention Mirror: Approximately 9-1/2 inches wide by 11 inches (241 mm wide by 279 mm) high; with mirror and integral frame formed from a single sheet of 0.038-inch- (0.95-mm-) **OR** 0.062-inch- (1.57-mm-), **as directed**, thick stainless steel; with round corners. Provide No. 8 **OR** 4, **as directed**, finish for mirror, chrome plating for frame.

a. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

3. Large, Framed Detention Mirror with Square Corners: Minimum 11 inches wide by 16 inches (279 mm wide by 406 mm) high; formed from 0.038-inch- (0.95-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet with fiberboard backing and No. 8 **OR** No. 4, **as directed**, finish; enclosed in a metal frame.

a. Frame: Formed from 0.064-inch (1.63-mm) nominal-thickness, chrome-plated steel **OR** 0.062-inch- (1.57-mm-) thick, stainless-steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel, **as directed**, sheet. Fabricate frame with welded and ground corners or from one piece of metal.

b. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

4. Large, Framed Detention Mirror with Round Corners: Minimum 11 inches wide by 16 inches (279 mm wide by 406 mm) high, formed from a single sheet of 0.038-inch- (0.95-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick stainless steel with No. 8 **OR** No. 4, **as directed**, finish; enclosed in a metal frame.

a. Frame: Formed from 0.064-inch (1.63-mm) nominal-thickness, chrome-plated steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel, **as directed**, sheet. Fabricate frame with welded and ground corners or from one piece of metal.

b. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

5. Large, Integrally Framed Detention Mirror with Round Corners: Minimum 11 inches wide by 16 inches (279 mm wide by 406 mm) high; with mirror and integral frame formed from 0.038-inch- (0.95-mm-) **OR** 0.062-inch- (1.57-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet; with round corners. Provide No. 8 **OR** 4, **as directed**, finish for mirror, chrome plating for frame.

a. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

I. Detention Grab Bars

1. Grab Bars: 1-1/2 inches (38.1 mm) in diameter; formed from 0.038-inch- (0.95-mm-) thick, stainless-steel tubing, with 3-inch- (76.2-mm-) diameter flanges formed from 0.125-inch- (3.18-mm-) thick, stainless steel. Closure plates formed from 0.125-inch- (3.18-mm-) thick, stainless steel. All-welded construction. Provide No. 4 finish.

a. Length: As indicated on Drawings **OR** 36 inches (914 mm) long, **as directed**.

b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

J. Detention Shower Seats

1. Shower Seats: Double-pan retractable, recessed shower seat with recessed handle. Approximately 16-inch by 16-inch (406-mm by 406-mm) overall size formed from 0.062-inch- (1.57-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet. Seat pivots on

solid 0.375-inch- (9.5-mm-) diameter stainless-steel rod and self-latches when closed. Minimum 750 lb. (340 kg) loading capacity. Provide No. 4 finish.

K. Fabrication
1. Coordinate dimensions and attachment methods of detention toilet accessories with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
2. Shear and punch metals cleanly and accurately. Remove burrs.
3. Form edges and corners to be free of sharp edges and rough areas. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12.7-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (0.8 mm) and support with concealed stiffeners.
4. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
5. Weld corners and seams continuously to comply with referenced AWS standard and the following:
   a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   b. Obtain fusion without undercut or overlap.
   c. Remove welding flux immediately.
   d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
   e. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
6. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure detention toilet accessories rigidly in place and to support expected loads. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce formed-metal units as needed to attach and support other construction.
7. Cut, reinforce, drill, and tap detention toilet accessories to receive hardware, security fasteners, and similar items.
8. Form exposed work true to line and level with accurate angles and surfaces. Grind off and ease edges unless otherwise indicated.
9. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed security fasteners of type indicated or, if not indicated, flat-head (countersunk) security fasteners. Locate joints where least conspicuous.

L. Finishes
1. Finish detention toilet accessories after assembly.
2. Steel Finishes:
   a. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   b. Factory Priming for Field-Painted Finish: Apply manufacturer's standard prime coat immediately after surface preparation and pretreatment.
   c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.2 mils (0.03 mm).
      1) Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
   d. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
3. Stainless-Steel Finishes: Remove tool and die marks and stretch lines or blend into finish.

a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation
1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing detention toilet accessories to in-place construction. Include threaded fasteners for concrete and masonry inserts, security fasteners, and other connectors.
2. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry or similar construction.
3. Apply security sealant around perimeter in a continuous ribbon on back of detention toilet accessories before installation.
4. Security Fasteners: Install detention toilet accessories using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel security fasteners in stainless-steel materials, **as directed**.

B. Field Quality Control
1. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
2. Remove and replace detention work where inspections indicate that work does not comply with specified requirements.
3. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
4. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

C. Adjusting And Cleaning
1. Remove temporary labels and protective coatings.
2. Adjust safety hooks to release with application of 8-lbf (35.6-N) load.
3. Painting: Immediately after erection, clean bolted connections and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
4. Touchup Painting: Cleaning and touchup painting of bolted connections and abraded areas of shop paint are specified in Division 07..

END OF SECTION 10 28 13 13a

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Task	Specification	Specification Description
10 28 13 13	01 22 16 00	No Specification Required
10 28 13 63	10 28 13 13	Toilet And Bath Accessories
10 28 13 63	10 28 13 13a	Detention Toilet Accessories

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SECTION 10 28 16 13 - BATH ACCESSORIES

DESCRIPTION OF WORK

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

GENERAL

Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

Submittals

2. Product Data.
3. Shop Drawings.
4. Quality Assurance/Control Submittals:
   a. Certificates: Submit manufacturer's written self certification that bath accessories meet or exceed specified requirements.

Quality Assurance

5. Regulatory Requirements: Comply with following:
   a. Accessibility:
      1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
         a) Uniform Federal Accessibility Standards (UFAS).
      2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
      3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
      4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
6. Mock-ups: Install one complete mock-up of bath accessories in each typical bathroom installation. Comply with Detailed Scope of Work for bathroom renovation mock-up requirements.
   a. Locations: As directed.
   b. Approved Mock-ups: Standard for rest of work.
   c. Approved Mock-ups: May remain part of completed project.

Scheduling

7. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

PRODUCTS

Bath Accessories

8. Ceramic Soap Dishes at Ceramic Tile Bathtub Surround: See Division 9 Section “Ceramic Tile.”
9. Metal Soap Dishes at Porcelain Steel Bathtub Surround:
   a. Recessed: FS WW-P-541/8B, Type VI, Class 2, heavy duty satin stainless steel.
   b. Fastenings: Plated expansion toggle or molly bolts, lead anchors or as required by existing wall conditions.

10. Safety Grab Bars: Type 304 stainless steel, minimum 32 mm (1-1/4 inch) OD, maximum 38 mm (1-1/2 inch) OD, 1.2 mm (18 gage) wall thickness in accordance with Uniform Federal Accessibility Standards (UFAS).
    a. Grab Bar Posts: Stainless steel.
    b. Post Flanges: Diameter of not less than 68 mm (2-11/16 inches) with center line of screw holes located minimum 13 mm (1/2 inch) from edges of flange.
11. Shower Curtains and Rods: By Bobrick Washroom Equipment, McKinney/Parker, or Leigh Products, or approved equal:
    a. Rods: Type 304 stainless steel, satin finish, adjustable length type to fit bathtub length, minimum 25 mm (1 inch) OD, minimum 1.0 mm (20 gage) wall thickness, similar to Bobrick No. B-6107 or McKinney/Parker No. 267.
    b. Flanges: Chrome plated cast brass or stainless steel.
    c. Shower Curtains: FS L-C-780a, Style I, opaque, matte white vinyl 0.2 mm (0.008 inch) thick, 1 829 mm (72 inches) by 1 829 mm (72 inches) high.
        1) Curtains: Germ proof, bacteria proof, and mildew resistant.
        2) Curtains: Similar to Bobrick No. 204-2 or McKinney/Parker No. 268SC.
    d. Curtain Hooks: Stainless steel, Type 304 or nickel plated brass wire, similar to Bobrick No. 204-1 or McKinney/Parker No. 269SH. Provide 12 hooks per curtain.
12. Other Bathroom Accessories: FS WW-P-541/8B, Type 304 stainless steel, satin finish, by Bobrick Washroom Equipment, McKinney/Parker, or Leigh Products, or approved equal:
    a. Surface Mounted:
        1) Medicine Cabinets: Type III, Class 2, Style S, swinging door, minimum 381 mm (15 inches) wide by 610 mm (24 inches) high. Provide complete with magnetic catch, three adjustable shelves, and full length mirror.
        2) Towel Bars: Type IV, Class 1, square bar, 610 mm (24 inches) long.
        3) Toilet Paper Holders: Type I, Class 1, Mounting S, Style A.
        4) Tumbler and Toothbrush Holders: Type VI, Class 4.
        5) Lavatory Soap Dishes: Type VI, Class 1.
        6) Robe hooks.
    b. Recessed:
        1) Medicine Cabinets: Type III, Class 2, Style R, enamel painted steel, swinging door, minimum 381 mm (15 inches) wide by 610 mm (24 inches) high. Provide complete with magnetic catch, three adjustable shelves, and full length mirror.
        2) Toilet Paper Holders: Type I, Class 1, Style K.
        3) Lavatory Soap Dishes: Type VI, Class 2.
13. Window Curtains and Rods: Provide over bathroom window openings.
    a. Rods: Solid steel with brass finish, minimum 10 mm (3/8 inch) diameter.
    b. Rod Brackets: Two brass-finished brackets with open tops and brass finish.
    c. Window Curtains: FS L-C-780a, Style II, opaque, matte white vinyl 0.2 mm (0.008 inch) thick.
        1) Curtains : Germ proof, bacteria proof, and mildew resistant.
        2) Size: To fit bathroom windows.
14. Joint Sealant: Mildew resistant one-component silicone; FS TT-S-001543A, Class A; ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, and A.
    a. Color: As selected from manufacturer's standard line.

EXECUTION

Examination

15. Site Verification of Conditions:
    1) Field Measurements: Verify field measurements.
    2) Existing Conditions: Ensure proper openings and blocking have been installed.

Installation

16. General: Install accessories rigidly and securely to blocking in walls using methods and materials recommended by manufacturer.
    a. Locations and Mounting Heights: As indicated or directed.
    b. Comply with Regulatory Requirements.
17. Bath Accessories: Securely install flanges for bath accessories and window curtain rods in accordance with manufacturer s recommendations and approved Shop Drawing.
    a. Safety Grab Bars: Install 100 mm (4 inch) by 100 mm (4 inch) perforated 1.2 mm (18 gage) galvanized steel plates at each post, flush to wall, by using toggle bolts, molly bolts, or anchors as required by conditions.
        1) After installation of wall finish, secure each grab bar flange to perforated plates through wall finish with three - 6 mm (1/4 inch) chrome plated machine screws, screwed into threaded sleeves or tee nuts welded to plates.
    b. Shower Curtains and Rods: Mount flanges to existing wall with approved expansion type inserts and chrome plated or stainless steel wood screws.
18. Bath Accessories at Bathroom with Porcelain Steel Surround:
    a. Metal Soap Dishes: Mount to new porcelain enamel panels and anchored securely to existing walls using approved mechanical fastenings.
        1) Waterproof with joint sealant between surround panel and dishes.
    b. China Soap Dishes: Anchor securely, using approved mechanical fastening.
    c. Safety Grab Bars: After installation of wall panels, secure each grab bar flange to perforated plates through panels with three - 6 mm (1/4 inch) chrome plated machine screws, screwed into threaded sleeves or tee nuts welded to plates.

Cleaning

19. Cleaning: Comply with requirements of Detailed Scope of Work.

END OF SECTION 10 28 16 13

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Task	Specification	Specification Description
10 28 16 13	10 28 13 13	Toilet And Bath Accessories
10 28 16 13	10 28 13 13a	Detention Toilet Accessories

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SECTION 10 28 19 16 - PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work
1. This specification covers the furnishing and installation of materials for plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary
1. This Section includes the following conventional plumbing fixtures and related components:
   a. Faucets for lavatories, bathtubs, bathtub/showers, showers, and sinks.
   b. Laminar-flow faucet-spout outlets.
   c. Flushometers.
   d. Toilet seats.
   e. Protective shielding guards.
   f. Fixture supports.
   g. Interceptors.
   h. Shower receptors.
   i. Dishwasher air-gap fittings.
   j. Disposers.
   k. Hot-water dispensers.
   l. Water closets.
   m. Urinals.
   n. Bidets.
   o. Lavatories.
   p. Commercial sinks.
   q. Shampoo bowls.
   r. Wash fountains.
   s. Bathtubs.
   t. Individual showers.
   u. Group showers.
   v. Whirlpool bathtubs.
   w. Kitchen sinks.
   x. Service sinks.
   y. Service basins.
   z. Laundry trays.
   aa. Sacristy sinks.

C. Definitions
1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
3. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
4. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
5. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
6. FRP: Fiberglass-reinforced plastic.
7. PMMA: Polymethyl methacrylate (acrylic) plastic.
8. PVC: Polyvinyl chloride plastic.

9. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

D. Submittals
1. Product Data: For each type of plumbing fixture indicated.
2. LEED Submittal:
   a. Product Data for Credit WE 2, 3.1, and 3.2: Documentation indicating flow and water consumption requirements.
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Operation and maintenance data
5. Warranty: Special warranty specified in this Section.

E. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" **OR** Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act", **as directed**; for plumbing fixtures for people with disabilities.
3. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
4. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
5. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
6. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
   b. Plastic Bathtubs: ANSI Z124.1.
   c. Plastic Lavatories: ANSI Z124.3.
   d. Plastic Laundry Trays: ANSI Z124.6.
   e. Plastic Mop-Service Basins: ANSI Z124.6.
   f. Plastic Shower Enclosures: ANSI Z124.2.
   g. Plastic Sinks: ANSI Z124.6.
   h. Plastic Urinal Fixtures: ANSI Z124.9.
   i. Plastic Whirlpool Bathtubs: ANSI Z124.1 and ASME A112.19.7M.
   j. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
   k. Slip-Resistant Bathing Surfaces: ASTM F 462.
   l. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
   m. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
   n. Stainless-Steel Residential Sinks: ASME A112.19.3.
   o. Vitreous-China Fixtures: ASME A112.19.2M.
   p. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
   q. Water-Closet, Flushometer Tank Trim: ASSE 1037.
   r. Whirlpool Bathtub Fittings: ASME A112.19.8M.
7. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
   a. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
   b. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
   c. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
   d. Faucets: ASME A112.18.1.
   e. Hose-Connection Vacuum Breakers: ASSE 1011.
   f. Hose-Coupling Threads: ASME B1.20.7.
   g. Integral, Atmospheric Vacuum Breakers: ASSE 1001.

h. NSF Potable-Water Materials: NSF 61.
i. Pipe Threads: ASME B1.20.1.
j. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
k. Supply Fittings: ASME A112.18.1.
l. Brass Waste Fittings: ASME A112.18.2.

8. Comply with the following applicable standards and other requirements specified for bathtub, bathtub/shower, and shower faucets:
   a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
   b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
   c. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
   d. Faucets: ASME A112.18.1.
   e. Hand-Held Showers: ASSE 1014.
   f. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
   g. Hose-Coupling Threads: ASME B1.20.7.
   h. Manual-Control Antiscald Faucets: ASTM F 444.
   i. Pipe Threads: ASME B1.20.1.
   j. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
   k. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
   l. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
9. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
   a. Atmospheric Vacuum Breakers: ASSE 1001.
   b. Brass and Copper Supplies: ASME A112.18.1.
   c. Dishwasher Air-Gap Fittings: ASSE 1021.
   d. Manual-Operation Flushometers: ASSE 1037.
   e. Plastic Tubular Fittings: ASTM F 409.
   f. Brass Waste Fittings: ASME A112.18.2.
   g. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
10. Comply with the following applicable standards and other requirements specified for miscellaneous components:
    a. Disposers: ASSE 1008 and UL 430.
    b. Dishwasher Air-Gap Fittings: ASSE 1021.
    c. Flexible Water Connectors: ASME A112.18.6.
    d. Floor Drains: ASME A112.6.3.
    e. Grab Bars: ASTM F 446.
    f. Hose-Coupling Threads: ASME B1.20.7.
    g. Hot-Water Dispensers: ASSE 1023 and UL 499.
    h. Off-Floor Fixture Supports: ASME A112.6.1M.
    i. Pipe Threads: ASME B1.20.1.
    j. Plastic Shower Receptors: ANSI Z124.2.
    k. Plastic Toilet Seats: ANSI Z124.5.
    l. Supply and Drain Protective Shielding Guards: ICC A117.1.
    m. Whirlpool Bathtub Equipment: UL 1795.

F. Warranty
1. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
   a. Warranty Period for Commercial Applications: One **OR** Three, **as directed**, year(s) from date of Final Completion.
   b. Warranty Period for Residential Applications of Shells: Five **OR** 20 **OR** 30, **as directed**, years from date of Final Completion.
   c. Warranty Period for Residential Applications of Pumps and Blowers: Five **OR** 20, **as directed**, years from date of Final Completion.

d. Warranty Period for Residential Applications of Electronic Controls: Five years from date of Final Completion.

1.2 PRODUCTS

A. Lavatory Faucets

1. Description: Single-control mixing **OR** Single-control nonmixing **OR** Two-handle mixing, **as directed**, valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
   a. Body Material: Commercial, solid brass **OR** General-duty, solid brass **OR** General-duty, solid brass or copper or brass underbody with brass cover plate **OR** General-duty, copper or brass underbody with brass cover plate **OR** Residential, nonmetallic underbody with brass cover plate **OR** Residential, nonmetallic underbody with nonmetallic cover plate, **as directed**.
   b. Finish: Polished chrome plate **OR** Polished brass **OR** Nonmetallic, **as directed**.
   c. Maximum Flow Rate: 0.5 gpm (1.5 L/min.) **OR** 2.2 gpm (8.3 L/min.) **OR** 2.5 gpm (9.5 L/min.), **as directed**.
      OR
      Maximum Flow: 0.25 gal. (0.95 L).
   d. Centers: 3-3/8 inches (86 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** Single hole **OR** Adjustable, **as directed**.
   e. Mounting: Deck, exposed **OR** Deck, concealed **OR** Back/wall, exposed **OR** Back/wall, concealed, **as directed**.
   f. Valve Handle(s): Lever **OR** Knob **OR** Knob, nonmetallic **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Push button **OR** Not applicable, **as directed**.
   g. Inlet(s): NPS 3/8 (DN 10) tubing, plain end **OR** NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
   h. Spout: Rigid **OR** Swing **OR** Rigid, gooseneck **OR** Swivel, gooseneck, **as directed**, type.
   i. Spout Outlet: Aerator **OR** Spray **OR** Laminar flow **OR** Plain end **OR** Spray, 0.5 gpm (1.5 L/min.), **as directed**.
   j. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor **OR** Self-closing, metering, **as directed**.
   k. Drain: Not required **OR** Pop up **OR** Stopper with chain **OR** Grid **OR** Lift and turn, **as directed**.
   l. Tempering Device: Mechanical **OR** Thermostatic **OR** Pressure balance **OR** Not required, **as directed**.

B. Bathtub Faucets

1. Description: Single-control mixing **OR** Two-handle mixing **OR** Three-handle mixing **OR** Push-button, metering, nonmixing, **as directed**, valve. Include hot- and cold-water indicators and tub spout. Coordinate faucet inlets with supplies.
   a. Body Material: Solid brass.
   b. Finish: Polished chrome plate **OR** Polished brass, **as directed**.
   c. Mounting: Deck **OR** Exposed, over rim **OR** Wall, **as directed**.
   d. Valve Handle(s): Lever **OR** Knob **OR** Knob, nonmetallic **OR** Cross, four arm **OR** Not applicable, **as directed**.
   e. Bathtub Spout: Chrome-plated brass with diverter, **as directed**.
   f. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor, **as directed**.
   g. Supply Connections: NPS 1/2 (DN 15) **OR** NPS 1/2 (DN 15), union **OR** Sweat, **as directed**.

C. Bathtub/Shower Faucets