

TECHNICAL SPECIFICATIONS

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SAN BERNARDINO, CA 92405**

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DIVISION	SECTION	TITLE
00		PROCUREMENT and CONTRACTING REQUIREMENTS
	00 3100	Available Project Information
01		GENERAL REQUIREMENTS
	01 2000	Contract Considerations
	01 3000	Administrative Requirements
	01 3114	Facility Services Coordination
	01 4200	Reference Standards and Definitions
	01 4500	Quality Control
	01 5000	Temporary Facilities
	01 5100	Temporary Utilities
	01 5713	Temporary Erosion Control
	01 5813	Temporary Project Sign
	01 6000	Product Requirements
	01 7000	Execution Requirements
	01 7800	Closeout Procedures
03		CONCRETE
	03 3000	Cast-in-Place Concrete
04		MASONRY
	04 0511	Mortar and Masonry Grout
	04 2000	Unit Masonry
	04 7300	Manufactured Stone Masonry
05		METAL
	05 5000	Metal Fabrications
06		WOOD, PLASTICS and COMPOSITES
	06 1000	Rough Carpentry
	06 1733	Wood I-Joists
	06 2000	Finish Carpentry
	06 4100	Architectural Wood Casework
	06 6400	Plastic Paneling
	06 8316	Fiberglass Reinforced Paneling
07		THERMAL AND MOISTURE PROTECTION
	07 2100	Thermal Insulation
	07 2500	Weather Barriers
	07 4113	Metal Roof Panels
	07 5400	Thermoplastic Membrane Roofing
	07 6200	Sheet Metal Flashing and Trim
	07 7100	Roof Specialties

DIVISION	SECTION	TITLE
	07 7123	Manufactured Gutters and Downspouts
	07 7200	Roof Accessories
	07 8400	Firestopping
	07 9005	Joint Sealers
08		OPENINGS
	08 1113	Hollow Metal Doors and Frames
	08 1416	Flush Wood Doors
	08 3100	Access Doors and Panels
	08 3323	Overhead Coiling Doors
	08 4113	Aluminum Framed Storefronts
	08 5313	Vinyl Windows
	08 6223	Tubular Skylights
	08 7100	Door Hardware
	08 8000	Glazing
	08 8300	Mirrors
	08 9100	Louvers
09		FINISHES
	09 2116	Gypsum Board Assemblies
	09 2400	Cement Plastering
	09 3000	Tiling
	09 5100	Suspended Acoustical Ceilings
	09 6519	Resilient Tile Flooring
	09 6566	Resilient Athletic Flooring
	09 6813	Tile Carpeting
	09 7000	Wall Coverings
	09 9113	Exterior Painting
	09 9123	Interior Painting
	099623	Anti-Graffiti Coating
10		SPECIALTIES
	10 1400	Signage
	10 2116	Shower and Dressing Compartments
	10 2600	Wall and Door Protection
	10 2800	Toilet and Bath Accessories
	10 4116	Rapid Entry Systems
	10 4400	Fire Protection Specialties
	10 5143	Turnout Gear Storage
	10 5500	Postal Specialties
	10 7500	Flagpoles
11		EQUIPMENT
	11 3013	Residential Appliances
	11 6613	Exercise Equipment
12		FURNISHING

DIVISION	SECTION	TITLE
	12 2400	Window Shades
	12 3600	Countertops
	12 5800	Residential Furniture
13		SPECIAL CONSTRUCTION
	13 3420	Metal Building Systems
21		FIRE SUPPRESSION
	21 1300	Fire Protection
22		PLUMBING
	22 0000	General Plumbing Requirements
	22 0500	Common Work Results for Plumbing
	22 0517	Sleeves and Sleeve Seals for Plumbing Piping
	22 0518	Escutcheons for Plumbing Piping
	22 0523	General-Duty Valves for Plumbing Piping
	22 0529	Hangers and Supports for Plumbing Piping and Equipment
	22 0553	Identification for Plumbing Piping and Equipment
	22 0719	Plumbing Piping Insulation
	22 1116	Domestic Water Piping
	22 1119	Domestic Water Piping Specialties
	22 1123	Domestic Water Pumps
	22 1316	Sanitary Waste and Vent Piping
	22 1319	Sanitary Waste Piping Specialties
	22 1323	Sanitary Waste Receptors
	22 1413	Facility Storm Drainage Piping
	22 1423	Storm Drain Piping Specialties
	22 1513	General Service Compressed Air Piping
	22 1519	General Service Packaged Air Compressors and Receivers
	22 3400	Fuel-Fired Domestic-Water Heater
	22 4213.13	Commercial Water Closets
	22 4216.13	Commercial Lavatories
	22 4216.16	Commercial Sink
	22 4223	Commercial Showers
23		MECHANICAL
	23 0000	General Mechanical Requirements
	23 0500	Basic Mechanical Materials and Methods
	23 0529	Hangers and Support For HVAC Piping and Equipment
	23 0548	Vibration and Seismic Controls for HVAC Piping and Equipment
	23 0553	Identification for HVAC Piping/Equip

DIVISION	SECTION	TITLE
	23 0593	Testing, Adjusting, and Balancing
	23 0713	Duct Insulation
	23 0719	HVAC Piping Insulation
	23 1123	Facility Natural Gas Piping
	23 3113	Metal Ducts
	23 3300	Air Duct Accessories
	23 3423	HVAC Power Ventilators
	23 3713	Diffusers, Registers and Grilles
	23 7433	Dedicated Outdoor Air Units
	23 3713	Diffusers, Registers and Grilles
	23 8126	Split-System Air Conditioners
26		ELECTRICAL
	26 0126	Electrical Acceptance and Start-Up Tests
	26 0510	General Electrical Requirements
	26 0519	Building Wires and Cables
	26 0526	Grounding and Bonding
	26 0529	Hangers and Supports
	26 0533	Raceways and Boxes
	26 0534	Outlet, Pull and Junction Boxes
	26 0553	Electrical Identification
	26 0573	Overcurrent Protection Devices
	26 0575	Overcurrent Protective Device Coordination Study
	26 0923	Lighting Control Devices
	26 2413	Switchboards
	26 2416	Panelboards
	26 2726	Wiring Devices
	26 2813	Fuses
	26 2816	Enclosed Switches and Circuit Breakers
	26 3001	Diesel Emergency Generator System
	26 5100	Interior Lighting
	26 5600	Exterior Luminaires
27		COMMUNICATIONS
	27 1300	Communications-Backbone Cabling
	27 2020	Data and Voice Infrastructure
31		EARTHWORK
	31 10 00	Site Clearing
	31 22 00	Grading
	31 23 16	Excavation
	31 23 23	Fill and Backfill
32		EXTERIOR IMPROVEMENTS
	32 13 13	Concrete Paving

DIVISION	SECTION	TITLE

	3201413	Precast Concrete Unit Paving
	32 17 13	Wheel Stops
	32 1726	Tactile Detectable Warning Tile
	32 3119	Decorative Metal Fences and Gates
	32 3313	Site Bicycle Racks
	32 84 00	Landscape Irrigation
	32 93 00	Trees, Plants and Ground Cover

33

UTILITIES

	33 5613	Above Ground Fuel Storage Tanks

APPENDIX A

Geotechnical Report

APPENDIX B

Gym/Exercise Equipment descriptions

**SECTION 00 3100
AVAILABLE PROJECT INFORMATION**

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:
- B. Certain information relating to existing surface and subsurface conditions and structures is available to bidders as follows:
- C. Geotechnical Report: Entitled Geotechnical Report Project S168-193 - Proposed New Fire Station APN 015-4281-01 prepared by Inland Foundation Engineering, Inc., dated August 20, 2024.
 - 1. Revision: Dated September 6, 2024
 - 2. Original copy is available for inspection with the project specifications, Appendix A.
 - 3. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
 - 4. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
 - 5. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 2000
CONTRACT CONSIDERATIONS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Schedule of Values.
- B. Application for Payment.
- C. Defect Assessment.
- D. Non-payment for Rejected Work.
- E. Change Procedures.

1.02 SCHEDULE OF VALUES

- A. Submit Schedule of Values for approval at Pre-Construction Meeting.
- B. Format: Submit typed schedule based upon the Schedule of Values
- C. Include in each line item, the amount of Allowances specified in this section.
- D. Include within each line item, a directly proportional amount of Contractor's Overhead and Profit.
- E. Revise Schedule to list approved Change Orders, on continuation sheet, with each Application for Payment.

1.03 APPLICATION FOR PAYMENT

- A. Submit two (2) copies of each Application on AIA Form G702 - "Application and Certificate for Payment".
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

1.04 DEFECT ASSESSMENT

- A. Replace the work, or portions of the work, not conforming to specified requirements.
- B. If in the opinion of the Architect, it is not practical to remove and replace the work, the Architect will direct one of the following remedies:
 - 1. The defective work may remain, but the listed schedule of value will be adjusted to a new value at the discretion of the Architect.
 - 2. The defective work will be partially repaired to the instructions and satisfaction of the Architect and the listed schedule of value will be adjusted to reflect a new value at the discretion of the Architect.

1.05 NON-PAYMENT FOR REJECTED WORK

- A. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined to be unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required work.
 - 5. Products remaining on hand after completion of the work.
 - 6. Loading, hauling and disposing of rejected products.

1.06 CHANGE PROCEDURES

- A. The Architect will advise of minor changes in the work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by the General Conditions on AIA Form G710 - "Architect's Supplemental Instructions".
- B. The Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications. Contractor will prepare and submit a detailed estimate within 5 days.

- C. The Contractor may propose a change by submitting a Change Order Request to the Architect, describing the proposed change and its full effect on the work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on work by separate or other contractors.
- D. Stipulated Sum Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's Change Order Request as approved by Architect.
- E. Construction Change Directive: Architect may issue a directive, signed by the Owner and Architect, instructing the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order. Document will describe changes in the work, and designate method of determining any change in Contract Sum or Contract Time. Promptly execute the change.
- F. Change Order Forms: Of type provided by the Owner.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- H. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item of work affected by the change and resubmit.
- I. Promptly revise progress schedules to reflect any changes in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change and resubmit.
- J. Promptly enter changes in Project Record Documents.

PART 2 PRODUCTS**2.01 -- NOT APPLICABLE --****PART 3 EXECUTION****3.01 -- NOT APPLICABLE--****END OF SECTION 01 20 00**

**SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Contractor's daily reports.
- F. Progress photographs.
- G. Coordination drawings.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Requests for Interpretation (RFI) procedures.
- K. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - PRODUCT REQUIREMENTS: General product requirements.
- B. Section 01 7000 - Execution Requirements: Additional coordination requirements.
- C. Section 01 7700 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 7000 - Execution Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

1.04 PROJECT COORDINATOR

- A. Project Coordinator: Construction Manager.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for worker access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for Interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Manufacturer's instructions and field reports.
 - 5. Progress schedules.
 - 6. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 7. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. It is Contractor's responsibility to submit documents in allowable format.
 - 3. Paper document transmittals will not be reviewed; email electronic documents for review.
 - 4. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.02 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, schedule of values, and progress schedule.
 - 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 6. Scheduling.
- D. Record minutes and distribute copies within 2 working days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Owner will schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
 - 1. Contractor.
 - 2. Owner.

3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
 2. Owner's requirements.
 3. Construction facilities and controls provided by Owner.
 4. Temporary utilities provided by Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Attendance Required:
1. Contractor.
 2. Architect.
 3. Contractor's superintendent.
 4. Major subcontractors.
- C. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Maintenance of quality and work standards.
 11. Effect of proposed changes on progress schedule and coordination.
 12. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216

3.06 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. Approximate count of personnel at Project site.
 5. Safety, environmental, or industrial relations incidents.

6. Meetings and significant decisions.
7. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
8. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
9. Testing and/or inspections performed.
10. Signature of Contractor's authorized representative.
11. Services connected and disconnected.

3.07 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of construction throughout progress of work produced by contractor's photographer, acceptable to Architect.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
 1. Foundations in progress and upon completion.
 2. Structural framing in progress and upon completion.
- E. Views:
 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 2. Consult with Architect for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 1. Delivery Medium: Via email.
 2. File Naming: Include project identification, date and time of view, and view identification.
 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.08 COORDINATION DRAWINGS

- A. Provide information required by Project Coordinator for preparation of coordination drawings.
- B. Review drawings prior to submission to Architect.

3.09 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 2. Prepare in a format and with content acceptable to Owner.
 3. Prepare using an electronic version of the form appended to this section.

- C. Review Time: Architect will respond and return RFIs to Contractor within 14 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

3.10 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Coordinate with Contractor's construction schedule and schedule of values.

3.11 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.12 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.15 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a single transmittal for related items.
 - 2. Transmit using approved form.
 - a. Use Contractor's form, subject to prior approval by Architect.
 - 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 4. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - 2. Collect required information into a single submittal.
 - 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 - 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 - 1. Transmit related items together as single package.
 - 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 - 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.16 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will not acknowledge receipt, and take no other action.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
 - 1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
 - 1. Final Unrestricted Release: When the Architect marks a submittal "No Exception Taken", the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents.
 - 2. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "No Exception Taken".
 - b. "Make Corrections Noted", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - 3. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 - 1. Items for which no action was taken:

- a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

NOT FOR BID

**SECTION 01 3114
FACILITY SERVICES COORDINATION**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Services of a coordinator for facility services construction.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Additional requirements for coordination.
- B. Section 01 6000 - PRODUCT REQUIREMENTS: Spare parts and maintenance materials.
- C. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 MECHANICAL AND ELECTRICAL COORDINATOR**1.04 SUBMITTALS**

- A. Submit name, address, and telephone number of coordinator and name of principal officer for review.
- B. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 COORDINATION REQUIRED**

- A. Coordinate the work listed below:
 - 1. Fire Suppression: Division 21.
 - 2. Plumbing: Division 22.
 - 3. Heating, Ventilating, and Air Conditioning: Division 23.
 - 4. Electrical: Division 26.
 - 5. Communications: Division 27.
 - 6. Electronic Safety and Security: Division 28.
 - 7. Site Utilities: Division 33.
- B. Coordinate progress schedules, including dates for submittals and for delivery of products.
- C. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- D. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.02 COORDINATION OF SUBMITTALS

- A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.

3.03 OBSERVATION OF WORK

- A. Observe work for compliance with Contract Documents.
- B. Maintain a list of observed deficiencies and defects; promptly submit.

3.04 DOCUMENTATION

- A. Observe and maintain a record of tests. Record:
 - 1. Name of Contractor, subcontractor, and _____.
 - 2. Name of testing agency and name of inspector.
 - 3. Date, time, and duration of tests.
- B. Submit copies of documentation to Architect upon request.

3.05 EQUIPMENT START-UP

- A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 7000.

3.06 INSPECTION AND ACCEPTANCE OF EQUIPMENT

- A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.

END OF SECTION

NOT FOR BID

**SECTION 01 4200
REFERENCE STANDARDS AND DEFINITIONS**

PART 1 GENERAL

1.01 REFERENCES

- A. The Contract Documents contain references to various standard specifications, codes, practices and requirements for materials, work quality, installation, inspections and tests, which references are published and issued by the organizations listed hereinafter by abbreviation and name. Such references are hereby made a part of these Contract Documents to the extent indicated or required.

1.02 DEFINITIONS

- A. General: Basic contract definitions are included in the General and Special Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown", "noted", "scheduled" and "specified" are used to help the user locate the reference. Location is not limited.
- C. "Directed": Terms such as "directed", "requested", "authorized", "selected", "approved", "required" and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.
- D. "Approved": The term "approved", when used in conjunction with the Architect's action on the Contractor's submittals, applications and requests, is limited to the Architect's duties and responsibilities as stated in the General and Special Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.
- G. "Install": The term "install" describes operations at the project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor or contractor of lower tier, who performs a particular construction activity including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
1. The term "experienced", when used with the term "installer", means having successfully completed previous projects similar in size and scope to this project, being familiar with the specified requirements indicated; and having complied with requirements of authorities having jurisdiction.
 2. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
 3. Assigning Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

- a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.
- J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing work as part of the Project. The extent of the project site is shown on the drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 2004 "Masterformat" numbering system.
- B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall", "shall be" or "shall comply with", depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such Standards are made a part of the Contract Documents by reference.
- B. When the effective date of a Reference Standard is not given, it shall be understood that the current edition or latest revision thereof and any amendments or supplements thereto in effect on the date of issue of these Contract Documents, as indicated by the date on the cover sheet or in the Invitation to Bid, shall govern the work.
- C. Conflicting Requirements: Where compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following list of general reference standards is common to the construction industry. This list is not all-inclusive nor does the presence of a reference standard imply necessarily that it is referenced in the Specifications or other Contract Documents.
- F.
- G. AAAluminum Association
- H. AABCAssociated Air Balance Council
- I. AAMA American Architectural Manufacturers Association
- J. AASHTO American Association of State Highway and Transportation Officials
- K. ACIAmerican Concrete Institute International
- L. ADCAmerican Diffusion Council
- M. AGAAmerican Gas Association
- N. AIAAmerican Institute of Architects
- O. AISCAmerican Institute of Steel Construction
- P. AISIAmerican Iron and Steel Institute
- Q. ALSCAmerican Lumber Standards Committee
- R. AMCAAir Movement and Control Association International
- S. ANSIAmerican National Standards Institute
- T. APAEngineered Wood Association (Formerly American Plywood Ass'n)
- U. ARIAir Conditioning and Refrigeration Institute
- V. ASCEAmerican Society of Civil Engineers
- W. ASHRAEAmerican Society of Heating, Refrigerating and Air Conditioning Engrs
- X. ASMEThe American Society of Mechanical Engineers
- Y. ASPEAmerican Society of Plumbing Engineers
- Z. ASSEThe American Society of Sanitary Engineers
- AA. ASTMAmerican Society for Testing and Materials
- BB. AWIArchitectural Woodwork Institute
- CC. AWSAmerican Welding Society
- DD. BHMABuilders Hardware Manufacturers Association
- EE. BIABrick Industry Association
- FF. CISCACeilings & Interior Systems Construction Association
- GG. CISPICast Iron Soil Pipe Institute
- HH. CLFMChain Link Fence Manufacturers Institute
- II. CRSIConcrete Reinforcing Steel Institute
- JJ. DHIDoor and Hardware Institute (Formerly Ntl. Builders Hardware Assoc)
- KK. EIMAEIFS Industry Manufacturers Association
- LL. FGMAFlat Glass Marketing Association
- MM. FMFactory Mutual Research Corporation

- NN. GAGypsum Association
 OO. GANAGlass Association of North America
 PP. IAPMOInternational Association of Plumbing and Mechanical Officials
 QQ. ICBOInternational Conference of Building Officials
 RR. ICCInternational Code Council
 SS. IEEEInstitute of Electrical and Electronics Engineers
 TT. IESNAIlluminating Engineering Society of North America
 UU. IGCCInsulating Glass Certification Council
 VV. MBMAMetal Building Manufacturers Association
 WW. NAAMMThe National Association of Architectural Metal Manufacturers
 XX. NCMANational Concrete Masonry Association
 YY. NEBBNational Environmental Balancing Bureau
 ZZ. NECANational Electrical Contractors Association
 AAA. NEMANational Electrical Manufacturers Association
 BBB. NETANational Electrical Contractors Association
 CCC. NFPANational Fire Protection Association
 DDD. NRCANational Roofing Contractors Association
 EEE. NSFNSF International (National Sanitation Foundation)
 FFF. PCAPortland Cement Association
 GGG. PDIPlumbing and Drainage Institute
 HHH. SDISteel Door Institute
 III. SGCCSafety Glazing Certification Council
 JJJ. SJISteel Joist Institute
 KKK. SMACNASheet Metal and Air Conditioning Contractors' National Association
 LLL. TCATile Council of America
 MMM. UBCUniform Building Code (International Conference of Building Officials)
 NNN. ULUnderwriters Laboratories, Inc.
 OOO. WCLIBWest Coast Lumber Inspection Bureau
 PPP. WDMAWindow and Door Manufacturers Association (Formerly NWWDA)
 QQQ. WI Woodwork Institute
 RRR. Federal Government Agencies and Acronyms: Names and titles of Federal Government standards - or specification-producing agencies are often abbreviated. The following abbreviations and acronyms which may be referenced in the Contract Documents indicate names of standards - or specification-producing agencies of the Federal Government. This list is not all-inclusive nor does presence on the list imply necessarily that the abbreviation is referenced in the Specifications or other Contract Documents.
 SSS.
 TTT. ADAAmericans with Disabilities Act
 UUU. CFRCode of Federal Regulations
 VVV. COECorps of Engineers, U S Army
 WWW. CPSCConsumer Product Safety Commission
 XXX. DOCDepartment of Commerce

YYY. DOTDepartment of Transportation
 ZZZ. EPAEnvironmental Protection Agency
 AAAA. FAAFederal Aviation Adiministration
 BBBB. FCCFederal Communications Commission
 CCCC. FDAFood and Drug Administration
 DDDD. FHAFederal Housing Administration
 EEEE. FSFederal Specifications and Standards (General Services Admin)
 FFFF. GSAGeneral Services Administration
 GGGG. MILMilitary Specifications and Standards (U S Dept of Defense)
 HHHH. NISTNational Institute of Standards and Technology
 IIII. OSHAOccupational Safety and Health Administration (U S Dept of Labor)
 JJJJ. PSPProduct Standards (U S Dept of Commerce)
 KKKK. USDAUnited States Department of Agriculture
 LLLL. USPSUnited States Postal Service
 MMMM.

PART 2 PRODUCTS

2.01 -- NOT APPLICABLE --

2.02

PART 3 EXECUTION

3.01 -- NOT APPLICABLE --

END OF SECTION 01 42 00

**SECTION 01 4500
QUALITY CONTROL****PART 1 GENERAL****1.01 SUMMARY**

- A. This section includes administrative and procedural requirements for quality-control services.
- B. Quality-Control services include inspections, tests and related actions, including reports performed and/or directed by the Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated in the Construction Documents. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

1.02 RESPONSIBILITIES

- A. Owner will employ and pay for services of an Independent Testing Laboratory to perform specified inspections and testing.
- B. Contractor Responsibilities:
 - 1. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the work, and to manufacturer's facilities.
 - 3. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
 - 4. Notify Architect/Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
 - a. Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
 - 1) Where individual sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
- C. Retesting: The Contractor is responsible for retesting where results of inspections, tests or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements.
 - 1. The cost of retesting construction, revised or replaced by the Contractor or Trade Subcontractor, is the Trade Subcontractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
 - 2. Associated Services: Cooperate with agencies performing required inspections, tests and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
 - a. Provide security and protection of samples and test equipment at the project site.
- D. Duties of the Testing Agency: The Independent Agency engaged to perform inspections, sampling and testing of materials and construction specified in individual sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
 - 1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
 - 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents or approve or accept any portion of the work.

- E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
 - 1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
- F. Owner reserves the right to employ an Independent Testing agency at any time.

1.03 SUBMITTALS

- A. The Independent Testing Agency shall submit a certified written report, in duplicate, of each inspection, test or similar service to the Architect and Structural Engineer. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
 - 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 - 2. Report Data: Written reports of each inspection, test or similar service include, but are not limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or tested work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.04 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as Reference Standards, comply with requirements of the Standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to Reference Standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of Standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties or responsibilities of the parties in contract nor those of Architect shall be altered from the Contract Documents by mention or inference in any reference document.

1.05 QUALITY ASSURANCE

- A. Qualifications of Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each Independent Inspection and Testing Agency engaged on the project shall be authorized by authorities having jurisdiction to operate in the state where the project is located.
- 2.

PART 2 PRODUCTS

2.01 -- NOT APPLICABLE --

2.02

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Section 01 7000 - "Execution Requirements".
- B.
- C. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- D. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.
- E. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.
- G. Have work performed by persons qualified to produce required and specified quality.
- H. Verify that field measurements are as indicated on Shop Drawings or and instructed by the manufacturer.
- I. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion and disfigurement.

3.02 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION 01 45 00

**SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Temporary sanitary facilities.
- B. Temporary Controls: Barriers and enclosures.
- C. Exterior Enclosures.
- D. Vehicular access and parking.
- E. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

- A. Section 01 5100 - Temporary Utilities.

1.03 TEMPORARY FACILITIES LOCATION

- A. Designated locations of temporary facilities shall be determined at the preconstruction meeting.

1.04 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.07 VEHICULAR ACCESS AND PARKING - SEE SECTION 01 5500

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Designated existing on-site roads may be used for construction traffic.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.08 WASTE REMOVAL

- A. See Section 017400 - Clean-up and disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.

- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.09 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 5100
TEMPORARY UTILITIES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls:
1. Temporary telecommunications services for administrative purposes.
 2. Temporary sanitary facilities required by law.

1.03 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Complement existing power service capacity and characteristics as required.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- D. Provide main service disconnect and over-current protection at convenient location and meter.
- E. Permanent convenience receptacles may be utilized during construction.
- F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain incandescent lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.

1.05 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.06 TEMPORARY VENTILATION

- A. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.07 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Contractor.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION - NOT USED****END OF SECTION**

**SECTION 01 5713
TEMPORARY EROSION CONTROL**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- B. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2017.
- C. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.; 1999a (Reapproved 2014).
- D. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015.
- E. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- F. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2016.

1.03 PERFORMANCE REQUIREMENTS

- A. Coordinate work of this section with Owner-provided "Storm Water Pollution Prevention Plan (SWPPP) if required by local enforcement agency.
 - 1. Where requirements of both plans are in conflict, comply with the SWPPP.
 - 2. SWPPP Plan not required if disturbed area is less than 1 acre.
- B. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
- D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.

3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 1. Prevent windblown soil from leaving the project site.
 2. Prevent tracking of mud onto public roads outside site.
 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- I. Open Water: Prevent standing water that could become stagnant.
- J. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Erosion and Sedimentation Control Plan:
 1. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 2. Obtain the approval of the Plan by authorities having jurisdiction.
 3. Obtain the approval of the Plan by Owner.
- C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
 1. Straw or hay.
 2. Wood waste, chips, or bark.
 3. Erosion control matting or netting.
 4. Polyethylene film, where specifically indicated only.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

- C. Bales: Air dry, rectangular straw bales.
 - 1. Cross Section: 14 by 18 inches, minimum.
 - 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
 - 2. Wood, 2 by 2 inches in cross section.
- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491/D4491M.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- C. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- D. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- E. Soil Stockpiles: Protect using one of the following measures:
 - 1. Cover with polyethylene film, secured by placing soil on outer edges.
- F. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
 - 1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
- G. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
 2. Install bales so that bindings are not in contact with the ground.
 3. Embed bales at least 4 inches in the ground.
 4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
 5. Fill gaps between ends of bales with loose straw wedged tightly.
 6. Place soil excavated for trench against bales on the upslope side of the row, compacted.
- B. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
 4. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 5. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Straw Bale Rows:
1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 57 13

**SECTION 01 6000
PRODUCT REQUIREMENTS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Products
- B. Re-use of existing products.
- C. Transportation and handling.
- D. Storage and protection.
- E. Product options.
- F. Substitutions.

1.02 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- C. Provide interchangeable components of the same manufacturer, for similar components.

1.03 TRANSPORTATION AND HANDLING

- A. Transport and handle Products in accordance with manufacturer's instructions
- B. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.
- C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.04 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- F.
- G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions

1.05 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

- C. Products specified by naming only one Manufacturer is intended to establish the standard required. It is not intended to limit the selection of equal products of other manufacturers.

1.06 SUBSTITUTIONS

- A. Architect/Engineer will consider requests for Substitutions only within 30 days after date of Owner Contractor Agreement.
- B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that the Contractor:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the Substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner
 4. Waives claims for additional costs or time extension which may subsequently become apparent.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution Submittal Procedure:
1. Submit six copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 2. Submit shop drawings, Product data, and certified test results attesting to the proposed product equivalence.
 3. The Architect/Engineer will notify Contractor, in writing, of decision to accept or reject request.
 - 4.

PART 2 PRODUCTS

EXISTING PRODUCTS

- A. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
- B. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is encouraged.

PART 3 EXECUTION

-- NOT APPLICABLE --

END OF SECTION 01 60 00

SECTION 01 7000 EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Submittals: Submittal procedures.
- B. Section 01 45 00 - Quality Control: Testing and inspection procedures.
- C. Section 01 5713 - Temporary Erosion Control: Additional erosion and sedimentation control requirements.
- D. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties.
- F. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- G. Section 01 9113 - General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.
- H. Section 02 4100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- I. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.
 - 2. Limitations on cutting structural members.

1.03 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.

1.04 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.
- B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and requirements of Section 01 30 00 - "Coordination" to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. Coordinate completion and clean-up of work of separate sections.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- G.

PART 2 PRODUCTS**2.01 -- NOT APPLICABLE --****2.02****PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.

- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Owner will locate and protect survey control and reference points.
- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.
- G.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 1. Remove items indicated on drawings.
 2. Relocate items indicated on drawings.
 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- D. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- E. Refinish existing surfaces as indicated:
 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- F. Clean existing systems and equipment.
- G. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- H. Do not begin new construction in alterations areas before demolition is complete.
- I. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Notify Architect and Owner seven days prior to start-up of each item.
- D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect.
 - 2. Provide copies to Owner.
 - 3. Provide copies to Architect and Owner.
- B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- C. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- D. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 70 00

**SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

PART 1 GENERAL**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- E. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- F. The following sources may be useful in developing the Waste Management Plan:
 - 1. State Recycling Department, at calrecycle.ca.gov.
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Owner.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - 4. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.

5. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 6000 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
 1. Relative amount of waste produced, compared to specified product.
 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
 3. Proposed disposal method for waste product.
 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 1. Prebid meeting.
 2. Preconstruction meeting.
 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 1. Provide containers as required.
 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

NOT FOR BID

**SECTION 01 7800
CLOSEOUT PROCEDURES AND SUBMITTALS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. This section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Inspection procedures for Completion Reviews.
 - 2. Final adjustments of accounts and payment.
 - 3. As-built drawings.
 - 4. Project record document submittal.
 - 5. Submittals and warranties.
 - 6. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate individual sections.

1.02 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspections for certification of Substantial Completion, complete the following:
 - 1. Conduct inspection to substantiate basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or non-conforming work, reason for being incomplete, and date of anticipated completion for each item.
 - 2. Advise the Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates and similar releases.
 - 5. Submit record drawings, maintenance manuals, damage or settlement surveys, property surveys and similar final record information.
 - 6. Deliver tools, spare parts, extra stock and similar items.
 - 7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems and instructions of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools and similar elements.
 - 9. Complete final cleanup requirements, including touchup painting.
 - 10. Touch up and otherwise repair and restore marred, exposed finishes.

1.03 FINAL COMPLETION REVIEW

- A. Within 5 days after receipt of request for final review, Architect will make site review to determine whether Work is complete following procedures indicated in Conditions of the Contract.
- B. Should Architect consider Work to be incomplete or defective:
 - 1. Architect will promptly notify Contractor listing incomplete or defective work.
- C. Contractor shall take immediate steps to remedy stated deficiencies and send second written request to Architect the Work is complete.
 - 1. Architect will reinspect the Work.
 - 2. Revisits for Site Reviews:
 - a. Should Architect have to re-perform site reviews due to failure of work to comply with claims of completion made by Contractor, Owner will reimburse Architect for such

additional services and will deduct amount of compensation from final payment to Contractor.

1.04 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

- A. Submit Contractor's affidavit of Payment of Debts and Claims on AIA Document G706.
- B. Submit Contractor's affidavit of Release of Liens on AIA Document G706A with:
 - 1. Consent of Surety to Final Payment: AIA G707.
 - 2. Contractor's Release of Waiver of Liens.
 - 3. Separate releases or waivers of liens from subcontractors, suppliers and others with lien rights against property of Owner, together with list of those parties.
- C. Execute Submittals before delivery to Owner.

1.05 FINAL ADJUSTMENTS OF ACCOUNTS

- A. Submit final statement of accounting to Architect.
- B. Show adjustments to Contract Sum:
 - 1. Original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders.
 - b. Allowances.
 - c. Unit prices.
 - d. Deductions for uncorrected work.
 - e. Deductions for inspection payments.
 - f. Other adjustments.
 - 3. Total Contract Sum.
 - 4. Previous Payments.
 - 5. Retainage.
 - 6. Sum remaining due.
- C. Architect will prepare final Change Order reflecting approved adjustments to Contract Sum which are not included in Change Orders previously processed.

1.06 FINAL APPLICATION FOR PAYMENT

- A. Submit final Application for Payment in accordance with procedures and requirements stated in Conditions of the Contract.
- B.
- C.

1.07 RECORD DOCUMENT SUBMITTALS (AS-BUILTS)

- A. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings. Mark the set to show the actual installation where installation varies substantially from the work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 1. Mark record sets with red ink. Use other colors to distinguish between variations in separate categories of the work.
 - 2. Mark new information that is important to the Owner but was not shown on Contract Drawings.
- B. Spare Parts and Extra Stock Inventory: Transmit spare parts and extra stock to the Owner with an inventory checklist for review by the Owner. Checklist shall include an itemized listing of each type of item and quantity, a method for the Owner to check off each item accepted, and a receipt for the Owner to sign and return to the Contractor accepting the entire inventory.
- C.

PART 2 PRODUCTS

2.01 -- NOT APPLICABLE --**2.02****PART 3 EXECUTION****3.01 CLOSEOUT PROCEDURES**

- A. Operation and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instructions by manufacturer's representatives if installers are not experienced in operation and maintenance procedures.
1. Include a detailed review of the following items:
 - a. Maintenance manuals.
 - b. Record documents.
 - c. Spare parts and manuals.
 - d. Tools.
 - e. Lubricants.
 - f. Fuels.
 - g. Identification systems.
 - h. Control sequences.
 - i. Hazards.
 - j. Cleaning.
 - k. Warranties and bonds.
 - l. Maintenance agreements and similar continuing commitments.
 2. As part of the instructions for operating equipment, demonstrate the following procedures:
 - a. Startup.
 - b. Shutdown.
 - c. Emergency operations.
 - d. Noise and vibration adjustments.
 - e. Safety procedures.
 - f. Economy and efficiency adjustments.
 - g. Effective energy utilization.
- B. Delivery of Spare Parts and Extra Stock: Deliver spare parts and extra stock to storage location designated by the Owner.

3.02 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Section 01 70 00 - "Execution Requirements".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site as directed by the Owner.
1. Where extra materials of value remain after completion of associated work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01 77 00

**SECTION 03 3000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete foundation walls.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, and thrust blocks.
- G. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- B. Section 32 1313 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete; 2016.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting; 2010.
- G. ACI 306R - Guide to Cold Weather Concreting; 2016.
- H. ACI 308R - Guide to External Curing of Concrete; 2016.
- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- J. ACI 347R - Guide to Formwork for Concrete; 2014, with Errata (2017).
- K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.
- O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.
- P. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- R. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.

- S. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.
- T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- U. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.
- V. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.
- W. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- X. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 2014.
- Y. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric); 2014.
- Z. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011 (Reapproved 2017).
- AA. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- C. Test Reports: Submit report for each test or series of tests specified.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type II - Moderate Portland type.
 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Barrier shall have all of the following qualities:
 1. Maintain permeance of less than 0.01 Perms [grains/(ft² ? hr ? inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
- B. Vapor barrier products:
 1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com <<http://www.stegoindustries.com>>.
 - a. Approved Alternate: Vaporguard by Reef Industries, 713-507-4250. www.reefindustries.com <<http://www.reefindustries.com>>.
 - b. Approved Alternate: PMPC by WR Meadows, 800-342-5976. <<http://www.wrmeadows.com/pmpc/>>
 2. Accessory products:
 - a. Seam Tape
 - b. Perimeter/terminated edge seal
 - c. Penetration Prevention
 - d. Vapor Barrier-Safe Screed System
- C. Form Release Agent: Material which will not stain concrete or absorb moisture.
- D. Sealer:
 1. Westcoat Specialty Coating Systems, 770 Gateway Center Drive - San Diego, CA 92102. (800) 250-4519 / www.westcoat.com.
 - a. EC-95 Polyurethane Topcoat (use as sealer).
 - 1) Two (2) coats.
 2. Apply in strict conformance with manufacturer's instructions.
 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- E. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 1. Complying with ASTM C881/C881M and of Type required for specific application.

- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
- D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- C. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
 - 1. Comply with ASTM C309 standards for water retention.
 - 2. VOC Content: Zero.
- D. Moisture-Retaining Sheet: ASTM C171.
 - 1. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.
- E. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- C. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: as indicated on drawings.
 - a. Foundation and Slab on Fill Concrete:
 - 1) Apparatus bay slab (28 days): 4,500 psi.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Water-Cement Ratio: Maximum as indicated on drawings percent by weight.
 - 4. Maximum Slump: as indicated on drawings inches.
 - 5. Maximum Aggregate Size: as indicated on drawings inch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.

- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Notify Architect not less than 24 hours prior to commencement of placement operations.
- C. Prepare base directly under concrete slabs smooth and compacted. No sharp gravel or protrusions permitted. Compacted sand over base is acceptable to smooth base prior to installation of vapor barrier. Sand or granular fill over vapor barrier is prohibited.
- D. No penetration of vapor barrier permitted.
- E. Prior to pouring, remove standing water by powered blower or other suitable means.
- F. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- G. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- H. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.05 CONCRETE FINISHING

- A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include ceramic tile with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include resilient flooring, seamless flooring, and thin set ceramic tile.
 - 3. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
 - 4. Broom finish (medium) at exterior flatwork.
 - 5. Light broom finish at Apparatus Building.
- B. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.06 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.07 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.08 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.09 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

**SECTION 04 0511
MORTAR AND MASONRY GROUT**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 01 4500 - Quality Control.
- B. Section 04 2000 - Unit Masonry System: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

- A. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2018.
- B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.
- C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- D. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.
- G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- H. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- I. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2018a.
- J. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- E. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C 1019.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

1.07 MIX TEST

- A. Testing of Mortar Mix: In accordance with ASTM C780.
- B. Test mortar mix for compressive strength.
- C. Testing of Grout Mix: In accordance with ASTM C1019.
- D. Test grout mix for compressive strength.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. Mortar Mix Designs: ASTM C270, Property Specification.

2.02 MATERIALS

- A. Portland Cement: ASTM C150 , Type II - Moderate; standard gray color.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Quicklime: ASTM C5, non-hydraulic type.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.

2.03 MORTAR MIXES

- A. Mortar for Reinforced Masonry: ASTM C270, utilizing the Proportion Method to achieve 1800 psi strength.

2.04 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 80 degrees F, or 2-1/2 hours at temperatures under 50 degrees F.
- F.

2.05 GROUT MIXES

- A. Grout: 2000 psi strength at 28 days; 10 inches slump.

2.06 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C 94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Request inspection of spaces to be grouted.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not displace reinforcement while placing grout.
- D. Remove excess mortar from grout spaces.

3.03 GROUTING

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 12 inches.
 - 2. Limit height of masonry to 16 inches above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.

4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:
1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
 2. Place grout for spanning elements in single, continuous pour.

END OF SECTION 04 05 11

NOT FOR BID

**SECTION 04 2000
UNIT MASONRY****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.

1.02 RELATED REQUIREMENTS

- A. Section 01 4500 - Quality Control
- B. Section 04 0511 - MORTAR AND Masonry GROUT.
- C. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- B. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- C. Samples: Submit two samples of decorative block units to illustrate color, texture, and extremes of color range.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS**2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 inches long by 8 inches high and 8 inches wide.
 - a. Split face texture on both sides at perimeter fence, texture on exposed side at trash enclosure and mechanical space.
 - b. Standard units-16 by 8 inches x 12 inches Split face
 - c. Wall Caps- 16" x 2" x 8" Precision
 - 2. Manufacturer:
 - a. RCP Block Co.; www.rcpblock.com
 - b. Orco Block; www.orco.com.
 - c. Angelus Block; www.angelusblock.com.
 - 3. Substitutions and Product Options: under provisions of Section 01 600 - "Product Requirements".
- B. Special Shapes: Provide nonstandard blocks configured for corners.
- C. Load-Bearing Units: ASTM C90, medium weight.

1. Grade N, Type 1-Moisture Controlled
2. Hollow block, as indicated.
3. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 0511.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, deformed billet bars of yield strength indicated on the structural drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 1. Bond: Running.

3.04 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.

3.06 BUILT-IN WORK

- A. As work progresses, install built-in fabricated metal frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.

3.07 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.08 CUTTING AND FITTING

- A. Cut and fit for pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.09 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.10 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

**SECTION 04 7300
MANUFACTURED STONE MASONRY**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Adhered manufactured stone masonry veneer (AMSMV).
- B. Installation materials.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood stud backup for AMSMV; plywood and OSB sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM C1670/C1670M - Standard Specification for Adhered Manufactured Stone Masonry Veneer Units; 2017.
- B. ASTM C1780 - Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer; 2018a.
- C. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.
- D. ASTM E2556/E2556M - Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment; 2010 (Reapproved 2016).
- E. ICC-ES AC51 - Acceptance Criteria for Precast Stone Veneer; 2016.
- F. NCMA (AMSV) - Installation Guide and Detailing Options for Compliance with ASTM C1780 for Adhered Manufactured Stone Veneer; Current Edition, Including All Revisions.
- G. MVMA (AMSV) - Installation Guide and Detailing Options for Compliance with ASTM C1780 For Adhered Manufactured Stone Veneer; 2018.
- H. NCMA TEK 20-01 - Key Installation Checkpoints for Manufactured Stone Veneer; 2014.
- I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for AMSMV units, mortar, lath, and water-resistive barrier, including:
 - 1. Preparation instructions and recommendations.
- C. Verification Samples: For each finish product specified, two samples, minimum size 12 inches square, representing actual product, color, patterns and texture.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 3 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified, with at least five years of documented experience.

1.06 MOCK-UP

- A. Construct mock-up panel 3 feet long by 4 feet high; include AMSMV, mortar, accessories, and substrate in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.08 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Adhered manufactured stone masonry veneer (AMSMV):
 - 1. Eldorado Stone: www.eldoradostone.com/#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 ADHERED MANUFACTURED STONE MASONRY VENEER (AMSMV)

- A. AMSMV: Cast masonry units using a mixture of cement, lightweight aggregates, concrete additives and color pigments to replicate appearance of natural stone and designed to be applied with a cementitious mortar to a backing surface, complying with ASTM C1670/C1670M and ICC-ES AC51.
 - 1. Style: Cut Coarse Stone.
 - 2. Color, Texture, Range, Special Shapes: Madrona.
 - 3. Walls: Provide with single color and texture throughout.
- B. AMSMV Trim: Provide wall caps and corner stones.
 - 1. Where noted on drawings.

2.03 MORTAR APPLICATIONS

- A. At Contractor's option, mortar may be made from factory premixed dry materials with addition of water only or ready-mixed.
- B. Mortar Color: Natural gray unless otherwise indicated.

2.04 MORTAR MIXES

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type S.
 - 2. Color: Standard gray.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

2.05 ACCESSORIES

- A. Water-Resistive Barrier: ASTM D226/D226M or ASTM E2556/E2556M.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that backup wall system construction complies with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.

3.02 PREPARATION

- A. Clean all surfaces thoroughly prior to installation.
- B. Use manufacturer surface preparation recommendations to achieve best result.

3.03 INSTALLATION - AMSMV

- A. Install AMSMV with a cementitious mortar setting bed to a scratch coat backing surface, in accordance with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.
- B. Product should be pulled from a variety of boxes and blended on site during installation to ensure a consistent overall project color on the wall.
- C. Install in accordance with manufacturer's installation instructions. Visit this page for detailed installation instructions - <https://www.coronado.com/InstallationGuide>
- D. Drystack joints.
- E. Caps: Install capstones where located on drawings.

3.04 INSTALLATION - MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.05 CONTROL AND EXPANSION JOINTS

- A. Form joints as detailed on drawings.

3.06 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.07 CUTTING AND FITTING

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

3.08 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean AMSMV in accordance with manufacturer's installation instructions.
 - 1. Installed manufactured stone veneer can be cleaned with a mild soap and water solution.
 - 2. Cleaning efflorescence can be done by lightly scrubbing the face of the stone with a soft bristle brush and water. In some cases, a 25% vinegar 75% water solution may need to be used. Do not use any harsh cleaning methods to remove efflorescence.

3.09 PROTECTION

- A. Protect finished work from rain during and for 48 hours following installation.
- B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- C. Touch-up, repair or replace damaged stone before completion of project.
- D. Water repellents and enhancers can be used to further protect a finished project. Only breathable, penetrating water-based silane water repellents should be used.

END OF SECTION

**SECTION 05 5000
METAL FABRICATIONS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Shop fabricated steel, ferrous metal , aluminum, ferrous metal , and ferrous metal items.
- B. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting: Paint finish.
- B. Section 09 9123 - Interior Painting: Paint finish.
- C. Section 32 3119 - Decorative Metal Fences and Gates.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014, with Editorial Revision (2017).
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2018.
- J. AWS A2.0 - Standard Welding Symbols.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.05 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings.

PART 2 PRODUCTS**2.01 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M.

- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- J. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: 3003-H14 alloy, H14, Mill finish.
 - 1. Perforated Metal: .0630 inch thick (14 gage)
- C. Bolts, Nuts, and Washers: Stainless steel.
- D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Joist Hangers: Strap anchors, fabricated with sheet steel, 18 gauge, 0.0478 inch minimum base metal thickness; galvanized finish.
- C. Trash enclosure gates.
- D. Exterior Signage: Support frame, substrate.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.05 SCHEDULE

- A. The Schedule is a list of principal items only. Refer to drawing details for items not specifically scheduled.
- B. Bollards: Stationary and removable. Steel pipe, concrete filled, crowned cap, as detailed; prime and paint finish.
- C. Metal fence panels and metal personnel gates, galvanized and powder coat.
- D. Metal Rolling Gate: galvanized and powder coated.
- E. Trash Enclosure Metal Canopy: galvanized.
- F. Trash Enclosure Gates: galvanized and painted.
- G. Fuel Tank / Generator Metal Canopy: galvanized and painted.
- H. Steel Awnings: galvanized and painted.
- I. Exterior Signage.

END OF SECTION 05 50 00

**SECTION 06 1000
ROUGH CARPENTRY****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Structural dimension lumber framing.
- B. Non-structural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Preservative treated wood materials.
- F. Miscellaneous framing and sheathing.
- G. Communications and electrical room mounting boards.
- H. Concealed wood blocking, nailers, and supports.
- I. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.
- B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- C. Section 06 1733 - Wood I-Joists.
- D. Section 07 6200 - SHEET METAL FLASHING AND TRIM: Sill flashings.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- D. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2018a.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- F. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.
- G. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
- H. PS 1 - Structural Plywood; 2009.
- I. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
- J. PS 20 - American Softwood Lumber Standard; 2015.
- K. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2015.
- L. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: as indicated on structural drawings.
- D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: as indicated on structural drawings.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.

2.03 TIMBERS FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry (23 percent maximum).
- C. Beams and Posts 5 inches and over in thickness:
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: as indicated on Structural Drawings.

2.04 STRUCTURAL COMPOSITE LUMBER

- A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.
- B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.

2.05 CONSTRUCTION PANELS

- A. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Structural 1 Sheathing.
 - 2. Bond Classification: Exterior..
 - 3. Performance Category: 1/2 PERF CAT.
- B. Wall Sheathing: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Structural 1 Sheathing.
 - 2. Bond Classification: Exterior.

3. Performance Category: 15/32 Perf Cat.
4. Span Rating: 24.
5. Edges: Square.
- C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- D. Other Applications:
 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 3. Other Locations: PS 1, C-D Plugged or better.

2.06 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

2.07 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

- A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.
 - 10. Signage
 - 11. Fans
 - 12. Light Fixtures

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. Nail panels to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

- C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Size and Location: As indicated on drawings.
 3. Size and Location: As indicated on drawings.
 4. Where boards are indicated as full floor to ceiling height, install with long edge of board parallel to studs.

3.07 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.09 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 06 1733
WOOD I-JOISTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wood I-joists for roof and floor framing.
- B. Bridging, bracing, and anchorage.
- C. Framing for openings.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.
- B. Section 06 1000 - Rough Carpentry: Material requirements for blocking, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

- A. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a (Reapproved 2018).
- B. ASTM D5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists; 2016.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
- D. PS 1 - Structural Plywood; 2009.
- E. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.
- C. Shop Drawings: Indicate sizes and spacing of joists, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between joists.
- D. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

1.05 QUALITY ASSURANCE**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.
- B. Protect products from damage due to weather and breakage.
- C. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks.
- D. Handle individual joists in the upright position.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Wood I-Joists:
 - 1. RedBuilt LLC; Redbuilt I-Joist: www.redbuilt.com//#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MATERIALS

- A. Wood I-Joists: Solid lumber top and bottom flanges and oriented strand board (OSB) webs bonded together with structural adhesive, with published span rating to meet project requirements.
 - 1. Span Rating: Established and monitored in accordance with ASTM D5055 by independent inspection agency.
 - 2. Oriented Strand Board: Comply with PS 2.
 - 3. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
 - 4. Fabrication Tolerances:
 - a. Flange Width: Plus/minus 1/32 inch.
 - b. Flange Thickness: Minus 1/16 inch.
 - c. Joist Depth: Plus 0, minus 1/8 inch.
 - 5. Marking: Mark each piece with depth, joist spacing, and allowable span for joist spacing.
- B. Wood-Based Components:
 - 1. Wood fabricated from old growth timber is not permitted.
- C. Joist Bridging: Type, size and spacing recommended by joist manufacturer.
- D. Wood Blocking, Plates, and Miscellaneous Framing: As specified in Section 06 1000.
- E. Fasteners: Electrogalvanized steel, type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports and openings are ready to receive joists.
- B. Verify that field measurements are as indicated on shop drawings.

3.02 PREPARATION

- A. Coordinate placement of bearing items.

3.03 ERECTION

- A. Install joists in accordance with manufacturer's instructions.
- B. Set structural members level and plumb, in correct position.
- C. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect.
- E. Install permanent bridging and bracing.
- F. Install headers and supports to frame openings required.
- G. Frame openings between joists with lumber in accordance with Section 06 1000.
- H. Coordinate installation of sheathing/decking with work of this section.

3.04 TOLERANCES

- A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION

**SECTION 06 2000
FINISH CARPENTRY****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Finish carpentry items other than shop prefabricated casework.
- B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Wood Casework Shop fabricated custom cabinet work.
- C. Section 08 1416 - Flush Wood Doors.
- D. Section 08 7100 - Door Hardware.
- E. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.
- F. Section 09 9123 - Interior Painting: Painting of finish carpentry items.
- G. Section 10 2800 - Toilet, Bath and Laundry Accessories.

1.03 REFERENCE STANDARDS

- A. ANSI/HPHA HP - American Standard for Hardwood and Decorative Plywood.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- D. FS MM-L-736 - Lumber; Hardwood.
- E. FS MMM-A-130 - Adhesive, Contact.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals" for submittal procedures.
- B. Product Data:
 - 1. Provide instructions for attachment hardware and finish hardware.
- C. Samples: Submit two samples of finish plywood, 4x4 inch in size illustrating wood grain and specified finish.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products under provisions of Section 01 6000 - "Product Requirements".
- B. Store materials in ventilated, interior locations under constant minimum temperatures of 60 degrees F and maximum relative humidity of 55 percent.
- C. Protect from moisture damage.

PART 2 PRODUCTS**2.01 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

2.02 LUMBER MATERIALS

- A. Softwood Lumber: PS 20; Custom Grade in accordance with WI (MAN). Douglas Fir Species, with flat grain, of quality capable of transparent finish.
- B. Hardwood Lumber: FS MM-L-736; Premium Grade in accordance with WI (MAN). Birch species, with flat grain, of quality capable of transparent finish.

2.03 SHEET MATERIALS

- A. Softwood Plywood: PS 1; Standard Sheathing Grade, Group 1, CD Appearance Quality; Douglas Fir species, with face veneer of rotary cut grain.

- B. Hardwood Plywood: ANSI/HPHA HP; Premium Grade in accordance with WI (MAN); veneer core material. Birch species, with face veneer of plain sliced grain.

2.04 PLASTIC LAMINATE MATERIALS

- A. Plastic Laminate: 0.050-inch General Purpose, manufactured by Formica, WilsonArt, or Nevamar.

2.05 ADHESIVE

- A. Adhesive: Type recommended by laminate manufacturer to suit application .
- B. Contact Adhesives: FS MMM-A-130; water base solvent release type.
- C. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.

2.06 ACCESSORIES

- A. Nails: Size and type to suit application, plain finish.
- B. Bolts, Nuts, Washers, Blind Fasteners, Lags and Screws: Size and type to suit application; plain finish.
- C. Lumber for Shimming and Blocking: Softwood lumber of Western White Pine species.
- D. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 HARDWARE

- A. Hardware: Comply with BHMA A156.9.
- B. #255 shelf standards and #229 rests as manufactured by Knappe & Vogt Manufacturing Company.

2.08 FABRICATION

- A. Fabricate to AWI/AWMAC/WI (AWS) Custom Standards.
- B. Shop prepare and identify components for book match grain matching during site erection.

2.09 SHOP FINISHING

- A. Shop finish work in accordance with AWI/AWMAC/WI (AWS) 'Factory Finishing', Section 5.
- B. Transparent Finish: AWI/AWMAC/WI (AWS) System Number 1; Premium.
- C. Opaque Finish: AWI/AWMAC/WI (AWS) System Number 7; Premium.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify that surfaces and openings are ready to receive work and field measurements are as shown on Shop Drawings and/or as instructed by the fabricator.
- C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
- D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

- A. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.03 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

- D. Install hardware supplied by Section 08 7100 - "Door Hardware" in accordance with manufacturer's instructions.
- E. Install Toilet and Bath accessories in accordance with manufacturer's instructions and as indicated on drawings.

3.04 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 9000 - "Painting and Coating".

3.05 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 06 2000

NOT FOR BID

**SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.
- C. Factory finishing.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Product Data: Provide data for hardware accessories.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
 - 5. Replace, repair, or rework all work for which certification is refused.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

PART 2 PRODUCTS**2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom Grade
 - 1. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 2. Finish - Semi-Exposed Surfaces: Decorative laminate
 - 3. Finish - Concealed Surfaces: Manufacturer's option.

4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
5. Casework Construction Type: Type A - Frameless.
6. Adjustable Shelf Loading: 50 lbs. per sq. ft.
7. Cabinet Style: Flush overlay.
8. Cabinet Doors and Drawer Fronts: Flush style.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 SHEET MATERIALS

- A. Medium Density Fiberboard (MDF); conforming to ANSI A208.
1. At Plastic laminate cabinets.
 2. Drawer construction
 - a. Gables and Backs
 - b. Shelving
- B. Hardboard: PS 58; pressed wood fiber with resin binder, standard grade, smooth one side, locate as follows:
1. Drawer Bottoms

2.04 LAMINATE MATERIALS

- A. Manufacturers:
1. Formica Corporation; <>: www.formica.com.
 2. Panolam Industries International, Inc; Nevamar Hi-Wear: www.panolam.com/#sle.
 3. Wilsonart; <>: www.wilsonart.com.
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, color as selected, finish as scheduled.
 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, color as selected, finish as scheduled.
 3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, white color, finish as scheduled.
 4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.05 COUNTERTOPS

- A. Countertops are specified in Section 12 3600.

2.06 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Edgeband thickness: 3mm
 2. Color: As selected by Architect from manufacturer's standard range.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Grommets: Standard stainless steel grommets for cut-outs, in color as indicated.

2.07 HARDWARE

- A. Shelf Standards and Rests: Knappe and Vogt #255 and #256. Shelf Standards to be flush mounted (recessed).
- B. Drawer and Door Pulls: EPCO 4" solid brass cabinet wire pull, Brushed Chrome finish.
- C. Cabinet Locks: National 8123.
- D. Catches: Magnetic, 2 on doors over 42-inches high.
- E. Drawer Slides: ANSI/BHMA Standards, Grade 2. Acceptable Manufacturers: Accuride, Stanley, Grant.
- F. Pull-Out Shelf Slides: ANSI/BHMA Standards, Full extension, 100 lb rating, 322 Accuride or approved equal.
- G. Hinges (5-Knuckle): EBB-2-26D-03 Institutional Hinge.
- H. Continuous Hinge: Rockler #34943, Stainless steel 1-1/16"W x 72"L
- I. Wood Locker Combination Lock: CompX National DUAL Axxess, Keyless combination Cam Lock, www.compx.com.
- J. Wood Locker Padlock hasp: Padlockable cam lock, polished chrome. Standard shackle size 3/8" dia. Manf.-Olympus Lock, Inc. #DCP-26D
 - 1. Strike Plate (at pair doors): Timberline SP-257
 - 2. Elbow Catch(at pair doors): Epcoc E1018-26
- K. Wood Locker closet Rod: KV660, 1 1/16" Dia. (cut to length), with KV757 flange.
- L. Wood Locker Robe Hook: Double prong Polished Chrome finish
- M. Provide soft-closing dampers on all drawers and doors (Hafele or equal).
- N. Counter Bracket: A and M Hardware Inc.;www.aandmhhardware.com, Work Station Bracket, color-gray. Size suited for location.
- O. Lazy Susan: Rev-A-Shelf 6942-28-11-52, size 28"dia.
- P. Folding Shelf Bracket: Rockler 8" x 8" , steel, gray color. 110 lb weight rating
- Q. Substitutions and Product Options: Under provisions of Section 01 6000 - "Product Requirements"

2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- D. Apply cabinet liner, NEMA LD3, Grade CLS, at all cabinet interiors, shelving and drawersides. Color to be white. Shelves to be lined on both faces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.

- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.05 SCHEDULES

3.06

END OF SECTION

**SECTION 06 6400
PLASTIC PANELING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Solid Surface Compression Molded Sheet Materials
 - 1. Shower walls with trim kit.

1.02 RELATED REQUIREMENTS

- A. Section 06 1053 - Miscellaneous Rough Carpentry.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
- C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each panel and trim type.
- C. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store products in clean, dry, interior areas in accordance with manufacturer's instructions.
- C. Store plastic panels and trim flat.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 10-year manufacturer warranty for products free from manufacturing defects. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Plastic Paneling/ Surfacing:
 - 1. Swan Corp. . www.swanstone.com, ph-800.325.7008
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 SOLID SURFACING MATERIAL

- A. Shower Wall Panels: solid surfacing material
 - 1. Size: .225 inch thick
 - 2. Type: Swanstone Smooth Glue Up single wall panels
 - 3. Trim: Metal trim kit for inside corners, edge.

4. Color: Solid color, selected by architect from standard selection.

2.03 ACCESSORIES

- A. Corner Soap Shelves
 1. Model: Swanstone Corner Soap Large ES-8
 2. Color: Match shower wall panels.
- B. Adhesives: Type recommended by panel manufacturer for application; not containing formaldehyde or volatile organic compounds.
- C. Joint Sealants: Type recommended by paneling manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrates are prepared to receive plastic paneling.
- B. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Surface Preparation: Clean substrate surfaces prior to installing paneling.

3.03 INSTALLATION - GENERAL

- A. Maintain manufacturer recommended gap tolerances between panels and adjacent abutments.
- B. Field-cut panels in accordance with manufacturer's written instructions. Make straight and square cuts; do not damage panels.

3.04 INSTALLATION - PLASTIC PANEL WALLS

- A. Install panels and trim in accordance with manufacturer's written instructions.
 1. Glue-down attachment over Cement board.
 2. Include Waterproofing Membrane between studs and cement board.
- B. Install wall panels plumb within specified tolerances.
- C. Install sealant to prevent water intrusion in accordance manufacturer's written instructions.

3.05 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch.

3.06 CLEANING

- A. See Section 01 7000 - Execution Requirements for additional requirements.

3.07 PROTECTION

- A. Protect installed plastic paneling from subsequent construction operations.

END OF SECTION

**SECTION 06 8316
FIBERGLASS REINFORCED PANELING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Fiberglass reinforced plastic panels.
- B. Trim.

1.02 REFERENCE STANDARDS

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 2 by 2 inch in size illustrating material and surface design of panels.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Crane Composites, Inc: www.cranecomposites.com/#sle.
 - 2. Marlite, Inc: www.marlite.com/#sle.
 - 3. Panolam Industries International, Inc; Panolam FRP: www.panolam.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 8 feet.
 - 2. Panel Thickness: 0.10 inch.
 - 3. Surface Design: Embossed.
 - 4. Color: As selected by Architect. From standard range.
 - 5. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.

- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

**SECTION 07 2100
THERMAL INSULATION****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- C. Sound Insulation

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

1.03 REFERENCE STANDARDS

- A. ASTM C165 - Standard Test Method for Measuring Compressive Properties of Thermal Insulations; 2007 (Reapproved 2017).
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 QUALITY ASSURANCE

- A. Thermal Conductivity: Where insulation is identified by "R" value, provide thickness required to achieve indicated value.

PART 2 PRODUCTS**2.01 APPLICATIONS**

- A. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.
- B. Insulation in Wood Framed Walls: Batt insulation with no vapor retarder.
- C. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 2. Thermal Resistance:
 - a. R of 38 at underside of roof.
 - b. R of 30 at underside of roof, metal building insulation, at Apparatus Bay. Batt insulation with white polypropylene facing.

- 1) Basis of Design: Bay Insulation, Lamtec WMP-VR-R-Plus (polypropylene/scrim/polyester).
- c. R of 21 at exterior walls and where indicated in plans.
3. Facing: Asphalt treated Kraft paper, one side.
4. Products:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.owenscorning.com/en-us.
 - d. Bay Insulation of California.Fresno, CA, PH:559-268-6330.
 - e. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Mineral Wool Blanket Sound Insulation: Flexible preformed insulation, complying with ASTM C167.
 1. Soundproofing Insulation.
 2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 3. Thickness: 3 inch.
 4. Location: Interior walls.
 5. Products:
 - a. ROCKWOOL; Safe N Sound: www.rockwool.com/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.03 ACCESSORIES

- A. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
 1. Width: 5-1/2 inches.
 2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
- B. Insulation Fasteners: Lengths of unfinished, 13-gauge, 0.072-inch high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

- F. Staple or nail facing flanges in place at maximum 6 inches on center.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.
- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

NOT FOR BID

**SECTION 07 2500
WEATHER BARRIERS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Weather barrier membrane.
- B. Seam Tape.
- C. Flashing.
- D. Fasteners.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 06 1000 - Rough Carpentry: Water-resistive barrier under exterior cladding.
- C. Section 07 2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.
- D. Section 07 5400 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.
- E. Section 07 6200 - SHEET METAL FLASHING AND TRIM: Metal flashings installed in conjunction with weather barriers.
- F. Section 07 9200 - Joint Sealants: Sealing building expansion joints.
- G. Section 09 2400 - Portland Cement Plaster (Stucco): Weather barrier under exterior stucco.

1.03 REFERENCE STANDARDS

- A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2018.
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016.
- C. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2000, with Editorial Revision (2012).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- F. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.
- G. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; 2016.
- H. ICC-ES AC108 - Acceptance Criteria for Flexible Flashing Materials; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Samples: Weather Barrier Membrane, minimum 8-1/2" x 11".
- D. Quality Assurance Submittals:
 - 1. Design Data, Test Reports: Provide Manufacturer's test reports indicating product compliance with indicated requirements.
 - 2. Manufacturer's Instructions: Provide manufacturer's written installation instructions.
 - 3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.
 - 1. Use building paper unless otherwise indicated.
 - 2. Under Portland cement stucco, use two separate layers of building paper.

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)

- A. Building Paper: Asphalt-saturated Kraft building paper complying with requirements of ICC-ES AC308 Grade D.
 - 1. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of five hours, when tested in accordance with AATCC Test Method 127.
 - 2. Manufacturers:
 - a. Fortifiber Building Systems Group; Super Jumbo Tex 60 Minute: www.fortifiber.com/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Sheathing fabric saturated with vapor retarder coating and complying with the applicable requirements of ICC-ES AC148.
- C. Primers:
 - 1. Provide manufacturer recommended primer to assist in adhesion between substrate and flashing.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.
- C. Mechanically Fastened Sheets - On Exterior:
 - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
 - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
 - 4. Install water-resistive barrier over jamb flashings.
 - 5. Install head flashings under weather barrier.
 - 6. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- D. Self-Adhered Sheets:
 - 1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
 - 2. Lap sheets shingle-fashion to shed water and seal laps air tight.
 - 3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
 - 4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.

5. At wide joints, provide extra flexible membrane allowing joint movement.
- E. Openings and Penetrations in Exterior Weather Barriers:
 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.
 1. Allow access to work areas and staging.
 2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
 3. Do not cover work of this section until testing and inspection is accepted.
- C. Coordination of ABAA Tests and Inspections:
 1. Provide testing and inspection required by ABAA QAP.
 2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
 3. Cooperate with ABAA testing agency.
 4. Allow access to air barrier work areas and staging.
 5. Do not cover air barrier work until tested, inspected, and accepted.
- D. Do not cover installed weather barriers until required inspections have been completed.
- E. Notify manufacturer's designated representative to obtain periodic observations of weather barrier assembly installation.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.
- B. Protect installed weather barrier from damage.

END OF SECTION

**SECTION 07 4113
METAL ROOF PANELS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Metal roof panel system of preformed steel panels.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Roof sheathing.
- B. Section 07 9200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2018.
- D. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Storage and handling requirements and recommendations.
 - 2. Installation methods.
 - 3. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- D. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- E. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

- B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Metal Roof Panel Manufacturers:
 - 1. Metal Sales, manufacturing corporation: www.metalsales.us.com, Fontana, CA Ph: 800.782.7953.
 - a. Basis of Design: Snap-Loc 24
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 PERFORMANCE REQUIREMENTS

- A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
 - 1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
 - 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
 - 3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.03 METAL ROOF PANELS

- A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
 - 1. Steel Panels:
 - a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 galvanizing.
 - b. Steel Thickness: Minimum 24 gauge, 0.024 inch.
 - 2. Profile: Standing seam, with minimum 3 inch seam height; concealed fastener system lapped seam in standing seam profile.
 - 3. Texture: Smooth.
 - 4. Width: Maximum panel coverage of 24 inches.

2.04 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.05 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer's standard line.

2.06 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
- C. Sealants:
 - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
- D. Underlayment: Self-adhering polymer modified asphalt sheet complying with ASTM D1970/D1970M, with strippable release film and top surface of woven polypropylene sheet.
 - 1. Sheet Thickness: 22 mil, 0.022 inch minimum total thickness.
 - 2. Products:
 - a. Polyglass USA, Inc; Polystick MTS Self-Adhered High Temperature Roof Underlayment: www.polyglass.us/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.
- B. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.
- C. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.
 - 1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
 - 2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.
- B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

3.04 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

NOT FOR BID

**SECTION 07 5400
THERMOPLASTIC MEMBRANE ROOFING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Vapor retarder.
- C. Cover boards.
- D. Flashings.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
- B. Section 07 7100 - Roof Specialties: Prefabricated roofing expansion joint flashing.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- C. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2017.
- D. NRCA (RM) - The NRCA Roofing Manual; 2018.
- E. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

- A. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- B. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- C. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

1.08 WARRANTY

- A. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years.
 - 2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
 - 1. GAF; EverGuard Extreme TPO 50 mil: www.gaf.com/#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
 - 1. GAF; EverGuard PVC XK Fleece Back 60 mil: www.gaf.com/#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

- A. Seaming Materials: As recommended by membrane manufacturer.
- B. Flexible Flashing Material: Same material as membrane.

2.03 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 - 1. Thickness: 5/8 inch, Type X, fire-resistant.
 - 2. Manufacturers:
 - a. Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.04 ACCESSORIES

- A. Prefabricated Roofing Expansion Joint Flashing: See Section 07 7100.
- B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- C. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.
- D. Sheathing Adhesive: Noncombustible type, for adhering gypsum sheathing to metal deck.
- E. Sheathing Joint Tape: Paper type, ____ inch wide, self-adhering.
- F. Membrane Adhesive: As recommended by membrane manufacturer.
- G. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 - 1. Composition: Asphaltic with mineral granule surface.
 - 2. Size: ____ by ____ inch.
 - 3. Manufacturers:
 - a. W.R. Meadows, Inc; Whitewalk: www.wrmeadows.com/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.

- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - WOOD DECK

- A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler.
- B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 INSTALLATION, GENERAL

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

3.04 INSTALLATION - MEMBRANE

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Install adhesive to substrate at rate of ____ gal/sq ft. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. At intersections with vertical surfaces:
 - 1. Fully adhere flexible flashing over membrane and up to nailing strips.
- E. Around roof penetrations, seal flanges and flashings with flexible flashing.
- F. Install roofing expansion joints where indicated. Make joints watertight.
 - 1. Install prefabricated joint components in accordance with manufacturer's instructions.
- G. Coordinate installation of roof drains and sumps and related flashings.

3.05 CLEANING

- A. See Section 01 7000 - Execution Requirements for additional requirements.
- B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- C. Remove bituminous markings from finished surfaces.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

**SECTION 07 6200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Coping.
- B. Roof flashings.
- C. Counter-flashings over base flashings.
- D. Counter-flashings at roof mounted mechanical equipment and vent stacks.

1.02 RELATED WORK

- A. Section 07 9200 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.
- E. FS O-F-506 - Flux, Soldering, Paste and Liquid.
- F. FS QQ-S-571 - Solder, Tin Alloy.
- G. FS SS-C-153 - Cement, Bituminous, Plastic.
- H. CDA A4050 - Copper in Architecture - Handbook; current edition.
- I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SYSTEM DESCRIPTION

- A. Work of this Section is to physically protect membrane roofing, and base flashings, from damage that would permit water leakage to building interior.
- B. Flashings and counter-flashings shall be installed at the junction of roofs with vertical surfaces and at all points as shown or as necessary to make work watertight.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products under provisions of Section 01600 - "Product Requirements".
- B. Stack preformed and pre-finished material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials during storage which may cause discoloration or staining, or damage.

PART 2 PRODUCTS**2.01 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 26 gauge, (0.0179 inch) thick base metal.

2.02 ACCESSORIES

- A. Fastener: Galvanized steel with soft neoprene washers at exposed fasteners
- B. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

- C. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- D. Plastic Cement: FS SS-C-153, Type I-asphaltic base cement.
- E. Solder: FS QQ-S-571.
- F. Flux: FS O-F-506.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.

2.04 FINISH

- A. Shop prepare and prime exposed ferrous metal surfaces.
- B. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15-mil.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Field measure site conditions prior to fabricating work.
- B. Install starter and edge strips, and cleats before starting installation.
- C. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- D. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges. Seal flashings into reglets with sealant.
- E. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Architect/Engineer.
- F. Lap and seal all joints.
- G. Apply plastic cement compound between metal flashings and felt flashings.
- H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- I. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

3.03 INSTALLATION

- A. Conform to drawing details included in SMACNA manual:

END OF SECTION 07620

**SECTION 07 7100
ROOF SPECIALTIES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Manufactured roof specialties, including copings and vents.

1.02 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.
- C. NRCA (RM) - The NRCA Roofing Manual; 2018.

1.03 SUBMITTALS

- A. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- C. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Roof Edge Flashings and Copings:
 - 1. ATAS International, Inc; Rapid-Lok Fascia: www.atas.com/#sle.
 - 2. Drexel Metals Inc; Fascia: www.drexmet.com/#sle.
 - 3. OMG Roofing Products; Formed Coping Plus: www.omgroofing.com/#sle.
 - 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Counterflashings:

2.02 COMPONENTS

- A. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
 - 3. Wall Width: As indicated on drawings.
 - 4. Material: Formed aluminum sheet, 0.040 inch thick, minimum.
 - 5. Finish: 70 percent polyvinylidene fluoride.
 - 6. Color: As indicated on drawings.

2.03 FINISHES

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

END OF SECTION

**SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Pre-finished galvanized steel gutters and downspouts.

1.02 RELATED REQUIREMENTS

Section 07 4113 - Metal Roof Panels

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2016).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.
- B. Comply with applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Gutters and Downspouts:
 - 1. ATAS International, Inc: www.atas.com/#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MATERIALS

- A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
 - 1. Finish: Shop pre-coated with modified silicone coating.
 - 2. Color: As selected by Architect from manufacturer's standard colors.

2.03 COMPONENTS

- A. Gutters: SMACNA rectangular style profile.
- B. Downspouts: SMACNA rectangular profile.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with SMACNA requirements.
- D. Fasteners: Galvanized steel, with soft neoprene washers.

2.04 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.

- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604, multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.06 ACCESSORIES

- A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
 - 1. Configuration: Angular.
 - 2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Slope gutters 1/8 inch per 10 feet .
- C. Connect downspouts to downspout boots at 6 inches above grade. Grout connection watertight.
 - 1. Connect to Landscape of site drainage as indicated in drawings.

END OF SECTION

**SECTION 07 7200
ROOF ACCESSORIES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Roof hatches.
- B. Attic vents.

1.02 RELATED REQUIREMENTS

- A. Section 07 7100 - Roof Specialties: Other manufactured roof specialty items.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for manufacture defects. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS**2.01 ROOF HATCHES AND VENTS**

- A. Attic Vents: square type; galvanized steel, formed to permit installation with metal panel roofing and to shed water.
 - 1. Cover and sub-flashing 26 ga., G90 galv. steel: Screen: 1/4" galvanized mesh
 - 2. Color: paint to match roof color.
 - 3. Products:
 - a. O'Hagins, Inc.: 210 Classic Ct., Rohnert Park, CA 94928. Ph: (800)324-0444., www.ohagin.com.
 - 1) Model: Standing Seam Metal, Low Profile, 78 SI NFVA.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

- A. See Section 01 7000 - Execution Requirements for additional requirements.
- B. Clean installed work to like-new condition.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 07 8400
FIRESTOPPING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- C. ITS (DIR) - Directory of Listed Products; current edition.
- D. FM (AG) - FM Approval Guide; current edition.
- E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- F. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- G. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Certificate from authority having jurisdiction indicating approval of materials used.
 - 1. Submit installation instructions and listing information from company that will supply the fire caulking seals for pipes, ducts, wires, etc. in fire resistive walls, floors, etc..

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Verification of minimum three years documented experience installing work of this type.
 - 2. Licensed by local authorities having jurisdiction (AHJ).

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

C.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
 2. Fire Ratings: See drawings for required systems and ratings.

2.03 MATERIALS

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
1. Durability and Longevity: Permanent.
 2. Color: Black, dark gray, or red.
 3. Manufacturers:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. 3M Fire Protection Products: www.3m.com/firestop.
 - c. Hilti, Inc: www.us.hilti.com.
 - d. Substitutions and Product Options: Under provisions of Section 01 60 00 - "Product Requirements".
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
- D.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

**SECTION 07 9200
JOINT SEALERS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- B. Section 08 8000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2017.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015e1.
- E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.

1.05 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS**2.01 SEALANTS**

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. General Purpose Exterior Sealant: Acrylic, solvent release curing; ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A; single or multi- component.
 - 1. Color: Match adjacent finished surfaces.
 - 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
 - 3. Products:
 - a. Red Devil; Siliconized Acrylic Construction Grade (35 Year) Sealant: www.reddevil.com.
 - b. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: www.sherwin-williams.com.
 - c. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
 - 1. Color: Match adjacent finished surfaces.
 - 2. Products:
 - a. Bostik Inc; <>: www.bostik-us.com.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

- D. Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - 1. Composition: Polyurea, Single or multi-part, 100 percent solids by weight.
 - 2. Hardness: 85 after 7 days, when tested in accordance with ASTM D2240 Shore A.
 - 3. Color: Concrete gray.
 - 4. Joint Width: 1/8 inch.
 - 5. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
 - 6. Products:
- E. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
 - 1. Color: Gray.
 - 2. Applications: Use for:
 - a. Joints in sidewalks and vehicular paving.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
- I. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9113 - Exterior Painting: Field painting.
- D. Section 09 9123 - Interior Painting: Field painting

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).
- D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- K. ITS (DIR) - Directory of Listed Products; current edition.
- L. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- N. UL (DIR) - Online Certifications Directory; Current Edition.
- O. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 3. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - 1) Level 2 for door over 3 ft wide.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - 3. Door Thickness: 1-3/4 inches, nominal.
 - 4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
 - 5. Door Face Sheets: Flush.
 - 6. Weatherstripping: Refer to Section 08 7100.
 - 7. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

- a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inches, nominal.
 4. Texture: Smooth faces.
 5. Door Finish: Factory primed and field finished.
- C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - b. Attach fire rating label to each fire rated unit.
 3. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. General:
1. Comply with the requirements of grade specified for corresponding door.
 - a. ANSI A250.8 Level 1 Doors: 16 gage frames.
 2. Finish: Same as for door.
- C. Exterior Door Frames: Full profile/continuously welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
 2. Weatherstripping: Separate, see Section 08 7100.
 3. Door frame with Sidelight.
- D. Interior Door Frames, Non-Fire Rated: Knock-down type.
1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
 2. Frame Finish: Factory finished.
- E. Interior Door Frames, Fire-Rated: Knock-down type.
1. Fire Rating: Same as door, labeled.

2.05 PREFINISHED DOOR FRAMES

- A. Manufacture: Timely Prefinished Steel Door Frames
- B. Interior Door Frames, Non-rated:
1. Frame Material: cold rolled steel
 2. "C" Series, 18 ga. thick
 3. Frame Casings: TA-8 Steel Casing, factory finish.
 4. Color selected by architect from standard selection.
- C. Interior Door Frames, Fire Rated:
1. Frame Material: cold rolled steel
 2. "CK" Series, 18 ga. thick
 3. Frame Casings: TA-8 Steel Casing, factory finish.
 4. Color selected by architect from standard selection.

2.06 ACCESSORIES

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
 - 1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.

2.07 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
- C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 7100.
- E. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

**SECTION 08 1416
FLUSH WOOD DOORS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing.
- C. Section 09 2116 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- D. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- G. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- H. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- I. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.
- J. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- C. Identifying Label: Each door shall bear identifying label indicating:
 - 1. Door manufacturer.
 - 2. Order number.
 - 3. Door number.
 - 4. Fire rating, if applicable.
- D.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section - 1 7700 - Closeout Procedures
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
 - 1. Haley Brothers: www.haleybros.com/#sle.
 - 2. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
 - 3. VT Industries, Inc; Basis of Design: www.vtindustries.com/#sle.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Wood veneer facing with factory transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- D. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
 - b. Stain: As selected by Architect.
 - c. Sheen: Flat.
- B. Factory finish doors in accordance with approved sample.

2.07 ACCESSORIES

- A. Pre-finished Steel Door Frames:
 - 1. Manufacturer: Timely Industries Inc., a division of SDS Industries, Inc. Web site www.timeleyframes.com; phone 800-247-6242.
 - 2. Interior: "S" Series, 20 ga thick.
 - 3. Interior: "CK" Series, 18 ga thick, with kerf for door seal/gasket. To be used at interior for rated openings as designated on plans.
 - 4. Finish: Color to be selected by Architect from Standard and Premium range.
 - 5. Substitutions: See Section 01 6000-Product Requirements.
- B. Metal Louvers:
 - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
- C. Glazing: See Section 08 8000.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
 - 1. Install Pre-Finished Steel frames in accordance with manufacturer's instructions.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

**SECTION 08 3100
ACCESS DOORS AND PANELS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Ceiling-mounted access units.
- B. Wall and ceiling mounted access units.
- C. Non-rated access doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Openings in partitions and ceilings.
- B. Section 09 9123 - Interior Painting

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS**2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Wall-Mounted Units:
 - 1. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
 - 2. Size: As indicated.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 5. Basis of Design; Model "M" manufactured by Milcor. (Or approved equal)
- B. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 - 4. Size - Other Ceilings: 12 by 12 inches.
 - 5. Size: As indicated
 - 6. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 7. Basis of Design; Model "DW" manufactured by Milcor. (Or approved equal)

2.02 MANUFACTURERS

- A. Milcor, Inc.
- B. J.L. Industries.
- C. Karp Associates, Inc.
- D. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.03 FABRICATION

- A. Fabricate frames, flanges and door panels of 16-gauge steel.
- B. Weld, fill and grind joints to ensure flush and square unit.
- C. Hardware: 165-degree steel hinges with removable pin, screw driver slot, quarter turn cam lock, cylinder lock with latch, two keys for each unit.

2.04 FINISH

- A. Galvanized units to be hot dipped finish. Prime coat units with alkyd primer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings for door and frame are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 3323 OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric operators and control stations.
- B. Accelerated Action overhead coiling doors, operating hardware, and electric operation.
- C. Wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 26 0533.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.
- C. Section 26 2726 - Wiring Devices: Power to disconnect.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).
- D. UL (DIR) - Online Certifications Directory; Current Edition.
- E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SYSTEM DESCRIPTION

- A. Electric motor operated unit with manual override in case of power failure.
- B. Within a framed opening. Surface mounted.

1.05 DESIGN REQUIREMENTS

- A. Design door assembly to satisfy non-operational Design Wind Speed without undue deflection or damage to door or assembly components.
 - 1. Design Ultimate Wind Speed of 125 MPH. In the event of high sustained wind load, use auxiliary chain hoist to open door

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.07 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. Basis of Design; Porvene Doors, Inc.: www.porvenedoors.com.
 - 2. Raynor Garage Doors: www.raynor.com/#sle.

3. Or approved equal.
4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 1. Basis of design: Model 422/ Accelerated Action System with chain override.
 - a. Use Model 422, manual with chain hoist, at Storage building.
 2. Capable of withstanding positive and negative wind loads of 40 psf, without undue deflection or damage to components.
 - a. Verify wind loads local Jurisdiction.
 3. Single thickness slats.
 4. Nominal Slat Size: 2 inches wide by required length.

2.03 MATERIALS AND COMPONENTS

- A. Curtain: conform to the following:
 1. Slats: Interlocking, minimum 22-gauge of ANSI/ASTM A653 steel, galvanized to minimum 1.25 oz/sq ft coating in accordance with ASTM A924. Cold roll formed in continuous lengths of 22 ga..
 2. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 3. Vision Lites: Rows of vision cutouts through curtain covered with clear Lexan polycarbonate. Number of rows and height as indicated on drawings.
 4. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
 5. Wear Straps: Polyester bands fitted vertically 1 per every 5 foot of curtain width.
 6. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
- B. Guide Construction: Two angles form a curtain guide and are bolted to a continuous wall angle. Sizes of structural steel angles are determined as required to retain curtain in guides under wind load and provide adequate mounting to jambs.
 1. Provide structural 3-Pc. guides with malleable windlocks.
- C. Hood Enclosure: 24-gauge galvanized steel; Internally reinforced to maintain rigidity and shape.
- D. Lock Hardware:
 1. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.
 2. Manual Chain Lift: Provide padlockable chain keeper on guide.
- E. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.04 FINISHES

- A. Curtain Slats: Galvanized steel. Pre -finished with zinc phosphate primer at manufacture.
 1. Powder coat finish (color as selected from RAL Chart). No field painting allowed.
- B. Steel Guides and Hood Enclosure: Galvanized steel. Pre-finished with zinc phosphate primer at manufacture.
 1. Powder coat finish (color as selected from RAL Chart). No field painting allowed.

2.05 FABRICATION

- A. Endlocks: Each end of alternate slats shall be fitted with endlocks to provide a wearing surface in the guides and to maintain slat alignment. Fastened with 1/4 inch rivets.
 1. Malleable Iron End-Locks: Malleable or "cast" iron end-locks shall be fitted onto every other slat.

- B. Bottom Bar: Curtain shall be reinforced with a bottom bar consisting of two 2 inch by 2 inch by 1/8 inch (50.8mm by 50.8mm by 3.21mm) structural steel angle with P.V.C. bulb astragal.
- C. Barrel: Shall be a steel pipe of diameter and wall thickness to restrict maximum deflection to 0.03 inch per foot (2.5mm/m) of door width. End bearings shall be self-lubricating ball bearings.
- D. Springs: Shall be oil tempered, grease packed helical torsion type designed with an overload factor of 25 percent. Springs mounted on a cold rolled steel inner shaft.
 - 1. High Cycle Springs: spring design is to last at least 50,000 cycles.
- E. Bracket Plates: 1/4 inch (6mm) minimum thickness steel plates to sustain and enclose ends of the door assembly.
- F. Drive end bracket plate: Fitted with a self-aligning sealed ball bearing.
- G. Guides: Shall be structural steel angles 3/16 inch (4.76mm) minimum thickness with removable head stops.
 - 1. Provide weather seal clip-on vinyl or weather stripping to seal against slat.
- H. Guide Wall Angles: 3/16 inch (4.76mm) minimum thickness structural steel angles.
- I. Hoods: Shall be 24 gauge galvanized powder coated to match slats. No field painting allowed.

2.06 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by UL (DIR) or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 - 1. Mounting: Side mounted.
 - 2. Gear hoist door operator, Model Pro-GH VFD with Red/Green warning light modification as manufactured by Micanan (or approved equal); 1.5 HP, mounted in accordance with manufacturer's specifications. Provide push button stations (interior) with radio control option.
 - a. Apparatus 2- use Wall Mounted motor, configure to clear ceiling height.
 - 3. 3-Channel Universal Receiver - Model 850LM
 - 4. Provide three (3) transmitters per door. Model 894LT.
 - a. Use four-button transmitters
 - 1) Button #1 - Open/Close apparatus door-back of station
 - 2) Button #2 - Open/Close apparatus door-street facing
 - 3) Button #3 - Open/Close rolling gate
 - 4) Button #4 - Open/Close rolling gate
 - 5. Controller Enclosure: NEMA EN 10250, Type 4.
 - 6. Opening Speed: 7 seconds per 14' opening.
 - 7. Brake: Manufacturer's standard type, activated by motor controller.
 - 8. Manual override in case of power failure.
 - 9. Refer to Section 26 0583 for electrical connections.
- C. Interior Control Station: Recessed, standard three button (open-close-stop) control for each operator; 24 volt circuit. (NEMA 250, Type 4).
- D. Commercial Protector System (CPS):
 - 1. Provide "non-contact" photo safety sensors designed to sense an obstruction between jambs and signals for the door operator to reverse to open. (NEMA 250, Type 4).
- E. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.
 - 1. Manufacturers:
 - a. Miller Edge, Inc; -: www.milleredge.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Complete wiring from disconnect to unit components.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components / under provisions of Division 1.
- B. Remove labels and visible markings.

END OF SECTION

**SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Door hardware.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Samples for Initial Selection: For units with factory applied color finishes including sample of hardware and accessories involving color selection.

- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Thermally-Broken:
 - 1. Basis of Design: Kawneer: Frame Style - Tri-Fab VG 451T. With GLASSvent project out windows. Door Style - Wide Stile 500 Barrier Free Entrance with 10-inch bottom. Permafluor High Performance finish.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Arcadia, Inc; -: www.arcadiainc.com/#sle.
 - 2. CRL-U.S. Aluminum.
- C. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
 - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.02 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Insulating Glazing, Not Thermally-Broken:
 - 1. Basis of Design: Kawneer 500 Barrier Free.
 - 2. Thickness: 1-3/4 inches.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Arcadia, Inc; -: www.arcadiainc.com/#sle.
- C. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
 - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.03 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Finish: High performance organic coatings.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.

- b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 2. Finish Color: As selected by Architect from manufacturer's standard line.
 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

2.04 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Glazing Stops: Flush.
- B. Glazing: See Section 08 8000.
 1. For Exterior Framing: Type IG-1.
- C. Swing Doors: Glazed aluminum.

2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- D. Glazing Accessories: See Section 08 8000.

2.06 FINISHES

- A. High Performance Organic Coating: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- B. Color: As selected by Architect from manufacturer's standard range.

2.07 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
 1. Finish on Hand-Contacted Items: Polished chrome.

2. For each door, include exit device, closer, and continuous hinge.
 3. Lockset per specifications Section 08 7100
- C. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
 1. See Section 08 7100 for hardware installation requirements.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.04 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.

- B. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

NOT FOR BID

**SECTION 08 5313
VINYL WINDOWS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Vinyl-framed, factory-glazed windows.
- B. Operating hardware.
- C. Insect screens.

1.02 RELATED REQUIREMENTS

- A. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2017.
- B. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2012.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).
- F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- G. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation; 2016.
- H. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007 (Reapproved 2016).
- I. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage.
- C. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- D. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing of type specified and with at least three years documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Vinyl Windows:
1. Milgard Windows and Doors; www.milgard.com;
 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 DESCRIPTION

- A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
1. Configuration: As indicated on drawings.
 2. Basis of Design: Milgard - Trinsic Series
 - a. Product Type: HS - Horizontal sliding window in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - b. Door Handles: Contemporary (standard)
 - c. Glazing: SunCoatMax Low-E.
 3. Color: as selected from standard range of 3 choices.
 4. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
 5. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
 6. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
 7. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
 8. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
 9. Insect Screens: Tight fitting for operating sash location.
 - a. Fiberglass: Better-vue

2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
1. Performance Class (PC): LC.
 2. Performance Grade (PG): 25, with minimum design pressure (DP) of 25.06 psf.
- B. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.
- C. Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 34, when tested in accordance with ASTM E90 and ASTM E1332.

2.04 COMPONENTS

- A. Glazing: Insulated double pane, annealed glass, gray tinted, low-E coated, with glass thicknesses as recommended by manufacturer for specified wind conditions and acoustic rating indicated.
- B. Frame Depth: 2-7/8 inch.
1. Sash: 1-3/16 inch depth.
- C. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
1. Hardware: Manufacturer's standard; quantity as required per screen.
 2. Screen Mesh: Aluminum mesh.
 3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.

2.05 HARDWARE

- A. Horizontal Sliding Sash: Rigid PVC interfacing tracks with screw adjustable nylon rollers in steel bracket, provide two sets for each operating sash and opening stops in head and sill track as required.
- B. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.

PART 3 EXECUTION**3.01 EXAMINATION****3.02 INSTALLATION**

- A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.
- B. Install windows in accordance with ASTM E2112.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.
- D. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Provide field testing of installed vinyl windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
 - 1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf.
 - 2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.27 psf.
- C. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.04 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
- B. Remove protective material from pre-finished surfaces.
- C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

END OF SECTION

**SECTION 08 6223
TUBULAR SKYLIGHTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 41 13 - Standing Seam Metal Roof Panels.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashing.
- C. Section 07 9200 - Joint Sealants: Sealants used in conjunction with skylights.

1.03 REFERENCE STANDARDS

- A. ASTM A463/A463M - Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process; 2015.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ICBO/ICC AC-16 - Acceptance Criteria for Plastic Skylights; '03.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. ICC-ES evaluation report.
- C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacture of tubular skylights for minimum of 10 years.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B.

1.08 WARRANTY

- A. Skylights: Manufacturer's standard warranty for 10 years.
- B.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solatube International, Inc. 2210 Oak Ridge Way
Vista, CA 92083-8341
Tel: (760) 597-440 / www.solatube.com
- B. Or approved equal.
- C. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 PRODUCTS

- A. Tubular Daylighting System: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube and ceiling level diffuser assembly, transferring sunlight to interior spaces, complying with ICBO/ICC AC-16.
- B. Brighten Up Series: Solatube Model 290 DS - 14 inch Daylighting System.
1. Roof Dome Assembly: DA - Dome Acrylic.
 2. Flashing Base:
 - a. FP - 4-inch Pitched Metal, Self Mounted -
 - b. Metal Roof Installation kit
 3. Diffuser Lens: L4 - White Trim with Vision Diffuser.
 4. Effect Lens: LN - Natural Effect Lens.
 5. Extension Tubes: EXX - Total Run Length to be determined by Bidding Contractor.

2.03 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Joint Sealant: As specified in Section 07 9200 - "Joint Sealants".

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Set roof assembly flashing in continuous bead of sealant.
- C. Seal joints exposed to weather using procedures specified in Section 07 9200 - "Joint Sealants".
- D. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 08 7000
DOOR HARDWARE****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Hardware for wood and hollow metal doors.
- B. Hardware for fire-rated doors.
- C. Gate locks.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 00 - Standard Steel Doors and Frames.
- B. Section 08 1416 - Flush Wood Doors.
- C. Section 32 3119 - Decorative Metal Fences and Gates

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. BHMA A156.1 - American National Standard for Butts and Hinges; 2016.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
- G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- J. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- K. CBC - 2022 California Building Code, based on 2021 International Building Code (IBC), with California Amendments.
- L. SDI - Steel Door Institute.
- M. DHI - Door Hardware Institute

1.04 COORDINATION

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.
- B. Coordinate work of this section with other directly affected sections involving manufacturer of any internal reinforcement for door hardware.

1.05 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
- D. Applicable provisions of federal, state, and local codes.
- E. Accessibility: ADA Standards and ICC A117.1.

1. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- F. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

1.06 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Indicate locations and mounting heights of each type of hardware.
- C. Submit Schedule of Hardware.
- D. Provide product data on specified hardware.

1.07 OPERATION AND MAINTENANCE DATA

1. Submit operation and maintenance data.
- B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventive maintenance.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 01 60 00 - "Product Requirements"
 1. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- B. Deliver keys to Owner by security shipment direct from hardware supplier.
- C. Protect hardware from theft by cataloging and storing in secure area.

1.09 MAINTENANCE PRODUCTS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.10 WARRANTY

- A. Provide five year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Allegion Brands, Ives, LCN, Schlage, Steelcraft, Von Duprin, or Glynn Johnson; -: www.allegion.com/us.
- B. Trimco Hardware; -: www.trimcohardware.com.
- C. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 GENERAL REQUIREMENTS

- A. Provide door hardware specified, or as required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
- B. Provide items of a single type of the same model by the same manufacturer.
- C. Provide products that comply with the following:
 1. Applicable provisions of federal, state, and local codes.
 2. Accessibility: ADA Standards and ICC A117.1.
 3. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
 4. Applicable provisions of NFPA 101, Life Safety Code.
 5. Fire-Rated Doors: NFPA 80.
 6. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.03 HINGES

- A. Refer to Hardware Sets.
- B. Hinges: Provide hinges on every swinging door.
- C. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 - 1. Provide ball-bearing hinges at all doors having closers.
- D. Provide hinges in the quantities indicated.
- E. Provide non-removable pins on exterior outswinging doors.
- F. Where electrified hardware is mounted in door leaf, provide power transfer hinges.

2.04 LOCKS AND LATCHES

- A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
- B. Hardware Sets indicate locking functions required for each door.
- C. If no hardware set is indicated for a swinging door provide an office lockset.
- D. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
- E. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.
- F. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
- G. Provide cams and/or tailpieces as required for locking devices required.
- H. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.05 KEYING

- A. Door Locks: Construction keying only. The Owner to provide key system compatible with the 6 pin system after acceptance of the building.
 - 1. Supply two (2) keys for each lock. 2.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of the correct characteristics.
- C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions, requirements of SDI and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.
- D. Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.03 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000 - Execution Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

3.04 SCHEDULE

- a. Numbers have been taken from the following:
- b. IVE -H.B.Ives, LCN -LCN Closers, SCE -Schlage Electronics, SCH-Schlage Lock Co., VON - Von Duprin,ZER -Zero Int, TRI-Trilogy

HW SET: 01**DOOR(S): LOBBY ENTRANCE**

1					
1	EA	CONT HINGE	112 XY	628	IVE
		CLASSROOM	L9070T 06A		
1	EA	LOCK		626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP-EDA	689	LCN
1	EA	PA MT PLATE	4040XP-18PA	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	SET	SEALS	BY DOOR/FRAME MFR		B/O
1	EA	THRESHOLD	103A-223 OR AS DETAILED	A	ZER

REMINDER OF HARDWARE BY DOOR MANUFACTURER.

HW SET: 02**DOOR(S): LOBBY WATCH**

2	31*	32			
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B- CS	630	IVE
1	EA	FLOOR STOP	FS439	630	IVE
1	EA	GASKETING	429AA-S	AA	ZER

*GASKETING REQUIRED ONLY AT DOOR 31.

HW SET: 03**DOOR(S): OFFICE**

3					
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	KEYLESS ACCESS LOCK	DL2700WPIC	626	TRI
1	EA	FLOOR STOP	FS 439	630	IVE

HW SET: 04**DOOR(S): PANTRY**

4					
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PASSAGE	ND10S RHO	626	SCH
1	EA	FLOOR STOP	FS439	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 05**DOOR(S): DINNING, HALL, APP. BAY**

5		22	46		
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP DL2700WPIS-Y	630	IVE
1	EA	KEYLESS LOCK		626	TRI
1	EA	SURFACE CLOSER	4040XP EDA ST-1944	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S/FS18L	BLK	IVE
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	102A OR AS DETAILED	A	ZER

HW SET: 06**PAIR DOOR(S): ELECT. PANELS**

27					
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQ.	626	IVE
1	EA	ASTRAGAL	47A(PAINT TO MATCH DR)	A	ZER

HW SET: 07**DOOR(S): FITNESS, APPARATUS EXIT**

7		50			
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA ST-1944	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S/FS18L	BLK	IVE
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	102A OR AS DETAILED	A	ZER

HW SET: 08

DOOR(S): EXERCISE / DAY

6					
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	630	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 09**DOOR(S): EXERCISE / HALL**

8					
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP ST-1630	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 10**DOOR(S): NOT USED****HW SET: 11****DOOR(S): COMM**

24					
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV REQUIRES WALL BACKING	630	IVE

HW SET: 12**DOOR(S): ICE*, JANITOR, FSR, SCBA, UTILITY**

35	36	37	44**	45	
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	PASSAGE SET	ND80TD RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

40.01 *OH STOP AND HOLDER 410F-630- AT DOOR 35; **4 HINGES AT DOOR 44.

HW SET: 13

DOOR(S): ACCESSIBLE RESTROOM, BATHS, APP. BAY RESTROOM

9*		10	11	12	13	26
31A		31B	33			
3	EA	HINGE		5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK		ND40S RHO	626	SCH
1	EA	SURFACE CLOSER*		4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE		8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	MOP PLATE		8400 4" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP		FS439	630	IVE
1	EA	GASKETING		188SBK PSA	BK	ZER
1	EA	KICK DOWN		FS452-4	626	IVE

*ACCESSIBLE RESTROOM-NO KICK DOWN

HW SET: 14

DOOR(S): SLEEP QUARTERS

14		15	16	17	18	19
20		21	23			
3	EA	HINGE		5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK		ND40S RHO	626	SCH
1	EA	SURFACE CLOSER		4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE		8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP		FS439	630	IVE
1	EA	GASKETING		188SBK PSA	BK	ZER

HW SET: 15

PAIR DOOR(S): MECH

25						
6	EA	HINGE		5BB1 4.5 X 4.5 NRP	652	IVE
1	SET	CONST LATCHING BOLT		FB51P	630	IVE
1	EA	DUST PROOF STRIKE		DP	626	IVE
1	EA	STOREROOM LOCK		ND80TD RHO	626	SCH
1	EA	COORDINATOR		COR X FL	628	IVE
2	EA	MOUNTING BRACKET		MB	689	IVE
2	EA	SURFACE CLOSER		4040XP PA ST-1755	689	LCN
2	EA	KICK PLATE		8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP		WS406/407CCV REQUIRES WALL BACKING	630	IVE
2	EA	SILENCER		SR64/SR65	GRY	IVE

HW SET: 16

DOOR(S): LAUNDRY

28		29			
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW SET: 17

DOOR(S): LOCKERS

47		48			
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	630	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 18

DOOR(S): HALL / APPARATUS

30		34			
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	EXIT DEVICE	99L-996L-R/V 06-6	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	102A OR AS DETAILED	A	ZER

HW SET: 19**DOOR(S): ELECTRICAL**

49					
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AX-99-L-NL-06	626	VON
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S/FS18L	BLK	IVE
1	EA	GASKETING	328AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	102A OR AS DETAILED	A	ZER

HW SET: 20**GATE:**

52					
1	EA	CLASSROOM LOCK ND50 RHO	626	SCH	

BALANCE OF HARDWARE BY GATE FABRICATOR**HW SET: 21****GATE(S):**

53					
1	EA	KEYLESS ACCESS	DL2700WPIC-26D	TRI	

BALANCE OF HARDWARE BY GATE FABRICATOR**END OF SECTION**

**SECTION 08 8000
GLAZING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units, doors, interior storefront, shower doors.
- C. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors.
- B. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- C. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- D. Section 10 2800 - TOILET AND BATH ACCESSORIES: Mirrors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- L. GANA (GM) - GANA Glazing Manual; 2008.
- M. GANA (SM) - GANA Sealant Manual; 2008.
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.
- O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).
- P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 2. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 3. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with ASCE 7.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 4. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 - 1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
5. Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality - Q6, with color and performance characteristics as indicated.
6. Safety Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality - Q5, complying with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I impact test requirements, and with color and performance characteristics as indicated.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Glass: Any of the manufacturers specified for float glass.
 2. Guardian Glass, LLC; -: www.guardianglass.com/#sle.
 3. Vitro Architectural Glass (formerly PPG Glass); -: www.vitroglazings.com/#sle.
 - a. Basis of Design
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Spacer Color: Black.
 4. Edge Seal:
 5. Color: Black.
 6. Purge interpane space with dry air, hermetically sealed.
- C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Optigray.
 - b. Coating: Solarban 60, on #2 surface.
 4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Use fully tempered where indicated on drawings.
 - b. Tint: Clear.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value), Winter - Center of Glass: 29, nominal.
 7. Solar Heat Gain Coefficient (SHGC): .30, nominal.

2.05 GLAZING UNITS

- A. Type G-2 - Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Fully tempered float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.
 5. Manufacturers:
 - a. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-rating period exceeding 45 minutes.
 1. Fire-Rating Period: As indicated on drawings.
 2. Manufacturers:
 - a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: www.safti.com/#sle.
 - b. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.
 - c. Vetrotech North America; Contraflam: www.vetrotechusa.com/#sle.

- C. Type G-3 - Monolithic Safety Glazing: Non-fire-rated.
 - 1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 - 2. Glass Type: Fully tempered safety glass as specified.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch, nominal.

2.06 GLAZING COMPOUNDS

- A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; black color.

2.07 ACCESSORIES

- A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 INSTALLATION, GENERAL

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.03 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.04 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 08 8300
MIRRORS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Glass mirrors.
 - 1. Tempered safety glass.

1.02 REFERENCE STANDARDS

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- B. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.
- C. GANA (GM) - GANA Glazing Manual; 2008.
- D. GANA (SM) - GANA Sealant Manual; 2008.
- E. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Mirrors:
 - 1. Glasswerks: www.glasswerks.com;
 - 2. Trulite Glass and Aluminum Solutions; -: www.trulite.com/#sle.
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MATERIALS

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.
 - 1. Thickness: 1/4 inch.
 - 2. Edges: Flat Polished.
 - 3. Size: As indicated on drawings.

2.03 ACCESSORIES

- A. Mirror Attachment Accessories: J-bar, Clips and adhesive.
 - 1. CLR J-bar Deep nose Aluminum J channel; Bright Anodized finish.
- B. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
 - 1. Application Temperature: Minus 35 to 140 degrees F at contact surfaces.

2. Volatile Organic Content (VOC): Less than 7 percent by weight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.

3.03 INSTALLATION

- A. Install mirrors in accordance with manufacturer's recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.
- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.
- D. Frameless Mirrors: Set mirrors with clips, and anchor rigidly to wall construction.
 1. Set mirror using J bar and adhesive applied in accordance with adhesive manufacture's instructions.

3.04 CLEANING

- A. Remove wet glazing materials from finish surfaces.
- B. Remove labels after work is complete.
- C. -Clean mirrors and adjacent surfaces.

END OF SECTION

**SECTION 08 9100
LOUVERS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - SHEET METAL FLASHING AND TRIM.
- B. Section 09 2400 - Portland Cement Plaster (Stucco).
- C. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Ruskin, 3900 Dr Greaves Rd., Kansas City, MO 64030, Ph: 816-761-7476. Web site: www.ruskin.com

2.02 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
- B. Drainable Stationary Louver: Architectural Louvers
 - 1. Model E4DS aluminum stationary louver
 - 2. Net free area 50% min.
 - 3. Extended sill where required.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louver frames in openings with concealed fasteners.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.
- E. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Building framing and sheathing.
- B. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- C. Section 07 2500 - Weather Barriers: Water-resistive barrier
- D. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- E. Section 07 9200 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- B. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2018b.
- E. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- G. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.
- H. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2016.
- I. GA-600 - Fire Resistance Design Manual; 2015.
- J. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS**2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
 1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- E. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 1. Fire-Resistance-Rated Partitions: As indicated in plans..
 2. Fire-Resistance-Rated Floor-Ceiling: One (1) hour fire rating.
 - a. Provide per ICC-ES report as indicated in drawing.
 3. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. CertainTeed Corporation; <>: www.certainteed.com.
 2. Georgia-Pacific Gypsum; <>: www.gpgypsum.com.
 3. Gold Bond Building Products; www.goldbondbuilding.com
 4. PABCO Gypsum; <>: www.pabco gypsum.com.
 5. USG Corporation; <>: www.usg.com.
 6. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required at restroom walls, restroom ceilings, washing machine and mop sink areas..
 3. At all locations use Type X board, UL or WH listed.
 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
- C. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 5/8 inch.
 - a. 1/2" where indicated in fire rated assemblies
 3. Edges: Tapered.
 4. Products:
 - a. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
 - b. Gold Bond- Fire Shield 1/2" thick, where indicated as proprietary product.
 - c. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.03 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3-1/2 inch.

- B. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or rigid plastic, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - 2. L-Trim: Sized to fit 5/8 inch thick gypsum wallboard. Flexible PVC for radiused opening.
 - 3. Products:
 - a. Same manufacturer as framing materials.
 - b. Cemco; www.cemcosteel.com; Ph-800-775-2362.
 - c. Trim-tex, Inc: www.trim-tex.com.
 - d. Fry Reglet Corp.. www.fryreglet.com.
 - e. Stockton Products: www.stocktonproducts.com.
 - f. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Joint Compound: Setting type, field-mixed.
- D. Textured Finish Materials: Latex-based compound; plain.
- E. Nails for Attachment to Wood Members: ASTM C514.
- F. Adhesive for Attachment to Concrete:
 - 1. Products:
 - a. Franklin International, Inc; Titebond PROvantage Professional Drywall Adhesive: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings; LN-2000 FUZE*IT All Surface Construction Adhesive: www.liquidnails.com/#sle.
 - c. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard.
- B. Studs: Space studs at 16 inches on center.
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
- C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- D. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions. See wall types in drawings

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.

- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - a. Prime drywall PRIOR to texturing.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding are not required at surfaces behind fixed cabinetry.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.
- B. Prime drywall PRIOR to texturing.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

**SECTION 09 2400
CEMENT PLASTERING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Cement plastering.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood stud framing for plaster.
- B. Section 07 2500 - Weather Barriers: Water-resistive barrier.
- C. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- B. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2018.
- C. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2018a.
- D. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering; 2006 (Reapproved 2013).
- E. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2019.
- F. ASTM C933 - Standard Specification for Welded Wire Lath; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide data on plaster materials and trim accessories.
- C. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

PART 2 PRODUCTS**2.01 CEMENT PLASTER APPLICATIONS**

- A. Lath Plaster Base: Metal lath.
 - 1. Plaster Type: Factory prepared plaster mix.
 - 2. Number of Coats: Three.
 - 3. First Coat: Apply to a nominal thickness of 3/8 inch.
 - 4. Second Coat: Apply to a nominal thickness of 3/8 inch.
 - 5. Leveling Coat: Apply to a nominal thickness of 1/32 to 1/16 inch.
 - 6. Finish: Acrylic.
- B. Solid Plaster Base: Concrete masonry.
 - 1. Number of Coats: Two.
 - 2. First Coat: Apply to a nominal thickness of 1/4 inch.
 - 3. Leveling Coat: Apply to a nominal thickness of 1/32 to 1/16 inch.
 - 4. Finish: Acrylic.

2.02 FACTORY PREPARED CEMENT PLASTER

- A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
 - 1. Manufacturer - Basis of Design:
 - a. LaHabra; FastWall 300 with Krak-Shield: www.lahabrastucco.com/#sle.
 - b. Parex USA: DRP Coating: www.parexusa.com
 - 2. Other Acceptable Manufacturers:
 - a. Dryvit Systems, Inc: www.dryvit.com/systems/stucco/#sle.
 - b. Sika Corporation: www.parex.com/#sle.
 - c. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Premixed Base Coats: Mixture of cement, aggregate, fibers, and proprietary admixtures for scratch and brown coats; install in accordance with ASTM C926.
- C. Premixed Leveling Coat: Acrylic polymer-based blend approved for use with plaster manufacturer's base coat and finish materials.
- D. Premixed Textured Coating: Polymer modified acrylic coating, integrally colored, and trowel applied to substrates prepared in accordance with manufacturer's written installation instructions.
 - 1. Color: As indicated on drawings.

2.03 ACCESSORIES

- A. Lath:
 - 1. Wire Size: 17 gauge, 0.453 inch.
 - 2. Galvanized: ASTM A641/A641M.
 - 3. Opening Size: 11/16 by 1-1/2 inches.
 - 4. Comply with ASTM C933.
- B. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring. Weight: as specified in ASTM C841 or ASTM C1063 for framing spacing.
- C. Weight: 2.5 lb/sq yd (1.4 kg/sq m). Min. 17 gauge.
- D. Finishing Accessories: ASTM C1063; extruded aluminum alloy (6063 T5), galvanized steel sheet ASTM A924/A924M G90, or rolled zinc, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed plaster edges.
- E. Galvanized Lathing Accessories: All galvanized metal moldings shall be 26 gauge thick, installed in full ten-foot minimum lengths wherever possible. Molding shall standard products specified, meeting ASTM D2201 (to be set for 7/8" grounds).
 - 1. Acceptable Manufacturers:
 - a. CEMCO (California Expanded Metal Company), City of Industry, CA (800 / 775-2362).
 - 2. Exterior Galvanized Plaster Corneraid: Stockton #Wire-CA.
 - 3. Exterior Galvanized / Plaster Plastic Nose Corner Bead: Stockton #Wire-PNCB.
 - 4. Conventional Arch-Aid: Stockton #Wire-AA.
 - 5. Plastic Nose Arch Bead: Stockton #Wire-DCB.
 - 6. Exterior "Long Flange" Galvanized / Plaster Plastic Nose Corner Bead: Stockton #Wire-PNLF.
- F. Control Joint; Cemco Double V #15, www.cemco.com.
- G. Drip Screed; Stockton Metals; www.stocktonproducts.com, Extruded products
 - 1. PCS: Plaster Channel Screed, Aluminum, 1/2" reveal.
- H. Bonding Compound: Provide type recommended for bonding plaster to solid surfaces, complying with ASTM C932.

- I. Reinforcing Mesh: 4.5 oz/sq yd alkali-resistant mesh.
- J. Water-Resistive Barrier: See Section 07 2500.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

3.02 PREPARATION

- A. Roughen smooth concrete surfaces and apply bonding compound in accordance with manufacturer's written installation instructions.

3.03 INSTALLATION - WATER-RESISTIVE BARRIER

- A. Where cement plaster is installed as part of a barrier wall system, install two layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions.
- B. Integrate water-resistive barrier with flashing accessories, and adjacent doors, windows, penetrations, and cladding transitions.
- C. Apply water-resistive barrier horizontally with upper layer lapped over lower layer at least 2 inches.
- D. For two layer applications, start with two horizontal layers at bottom of exterior wall or structure.

3.04 MIXING

- A. Mix only as much plaster as can be used prior to initial set.
- B. Mix materials dry, to uniform color and consistency, before adding water.
- C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.
- D. Admix - Acrylic Bonder & Admix.

3.05 APPLICATION

- A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
- B. Base Coats:
 - 1. Apply base coat(s) to fully embed lath and to specified thickness.
 - 2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.
- C. Leveling and Reinforcing Coat (Fastwall 100 Krak-Shield Stucco Assembly):
 - 1. After Moist Curing, allow Stucco Base to air dry a minimum of 24 hours before applying the leveling and reinforcing coat.
 - 2. Using a stainless steel trowel, apply the Stucco Level Coat over the Stucco Base at a thickness of $\frac{1}{16} - \frac{3}{32}$ in. (1.6 – 2.4 mm).
 - 3. Fully embed the Standard Mesh into the wet Stucco Level Coat including diagonal strips at corners of openings and trowel smooth. If Standard Mesh is used, seams are overlapped $2\frac{1}{2}$ in (63 mm).
- D. Finish Coats:
 - 1. Primer and Acrylic Coatings:
 - a. Remove surface contaminants such as dust and dirt without damaging substrate.
 - b. Apply primer in accordance with manufacturer's instructions.
 - c. Apply finish coating in number of coats and to thickness recommended by manufacturer.

- d. Before the application of the finish, the base coat must have cured a minimum of 24 hours or longer as required by weather conditions. Examine the cured base coat for any irregularities.
- e. Texture; Sand smooth finish.

3.06 TOLERANCES

- A. Maximum Variation from True Flatness: 1/4 inch in 10 feet.

3.07 REPAIR

- A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION

NOT FOR BID

**SECTION 09 3000
TILING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Setting materials.
- E. Grout materials.
- F. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Substrate for mortar bed.
- B. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- C. Section 09 2400 - Cement Plastering: Lath and Portland cement scratch coat, where required by the TCNA (HB) Method specified.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
- B. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- C. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.
- D. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).
- E. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
- F. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).
- G. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- H. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.
- I. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.
- J. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018.
- K. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

1. Mortar and grout manufacturer's technical data sheets indicating suitability for the installation specified and compliance standards.
- C. Samples: Submit the following for each type, color, size and finish included in the work.
 1. Full size tile and trim shapes.
 2. Grout color samples.
 3. Sealant color samples and Prefabricated Joint/Transition Strip samples.
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - PRODUCT REQUIREMENTS, for additional provisions.
 2. Extra Tile:
 - a. Provide (3) three extra boxes each of porcelain wall and floor tile.
 - b. Provide (2) two extra boxes of Quarry tile.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications: Natural Stone Institute (NSI) Accredited Commercial B Contractor (light commercial): www.naturalstoneinstitute.org/#sle.
- C. Installer Qualifications:
 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.
- C. Illuminate the work area during installation providing the same level and angle of illumination as will be available for final inspection.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers:
 1. Arizona Tile
 2. Dal-Tile Corporation: www.daltile.com/#sle.
 3. Emser Tile, LLC: www.emser.com/#sle.
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Glazed Wall Tile: ANSI A137.1, standard grade.
 1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
 2. Size: 4 by 12 inch, nominal.
 3. Edges: Square.
 4. Surface Finish: High gloss.
 5. Color(s): as selected by architect from standard colors..
 6. Products:
 - a. Basis of Design: DalTile Corporation: www.daltile.com/ Linear, Color Wheel Collection.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. Porcelain Tile: ANSI A137.1, standard grade.
 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.

2. Size: 2 in by 2 in. mosaic, used at restroom floors.
3. Thickness: .250 inch.
4. Edges: Square.
5. Surface Finish: Unglazed.
6. Color(s): To be selected by Architect from manufacturer's standard range.
7. Products:
 - a. Dal-Tile Corporation; Portfolio: www.daltile.com/#sle. Basis of Design
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 1. Applications:
 - a. Open edges of wall tile.
 - b. Open edges of floor tile.
 - c. Floor to wall joints.
 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com. Basis of Design
 - 1) Styles as indicated in drawings.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 1. LATICRETE International, Inc; -: www.laticrete.com/#sle.
 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
 1. Applications: Where indicated on drawings.
 2. Products:
 - a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: www.custombuildingproducts.com/#sle.
- D. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
- E. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

2.04 GROUTS

- A. Grout: Tile Council of America (TCA) formula AARII HT, Epoxy resin. (Sand grout will not be accepted).
 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products:
 - a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.
 - b. LATICRETE International, Inc; LATICRETE 1600 Unsanded Grout: www.laticrete.com/#sle.
 - c. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Grout: www.merkrete.com/#sle.
 - d. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 1. Applications: Where indicated.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products:

- a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
- b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
- c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
- d. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.05 MORTAR MIX AND GROUT MIX

- A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions and TCA Handbook for Ceramic Tile Installation.

2.06 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 2. Fluid or Trowel Applied Type:
 - a. Thickness: 20 mils, maximum.
- B. Waterproofing Membrane -: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 1. Mortar Bonded Sheet Type:
- C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- C. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- D. Form internal angles square and external angles square.
- E. Install non-ceramic trim in accordance with manufacturer's instructions.
- F. Sound tile after setting. Replace hollow sounding units.

- G. Keep control and expansion joints free of mortar, grout, and adhesive.
- H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- I. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- J. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
 - 2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F132, bonded.
 - 3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.
- B. Cleavage Membrane: Lap edges and ends.
- C. Mortar Bed Thickness: 1-1/4 inch, unless otherwise indicated.

3.06 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At shower walls install in accordance with TCNA (HB) Method B411, mortar bed on studs with waterproofing membrane.
- B. Grout with standard grout as specified above.

3.07 INSTALLATION - WALL TILE

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244. Where indicated on drawings.
- C. At walls where indicated install in accordance with TCNA (HB) Method B411, mortar bed on studs with waterproofing membrane.

3.08 CLEANING

- A. Clean tile and grout surfaces.

3.09 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.
- B. Protect finished installation.

END OF SECTION

**SECTION 09 5100
SUSPENDED ACOUSTICAL CEILINGS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Perimeter trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 2100 - Thermal Insulation: Acoustical insulation.
- B. Section 08 3100 - Access Doors and Panels: Access panels.
- C. Division 23 - HVAC: Air diffusion devices in ceiling.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 2 by 2 inch in size illustrating material and finish of acoustical units.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - PRODUCT REQUIREMENTS, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer: Company approved by manufacturer.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.
- B.

1.08 EXTRA MATERIALS

- A. Provide one (1) unopened carton of each type of acoustical unit for Owner's use in maintenance of project.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc; -: www.armstrongceilings.com/#sle.

2. CertainTeed Corporation; -: www.certainteed.com/#sle.
 3. USG Corporation; Basis of Design: www.usg.com/ceilings/#sle.
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Suspension Systems:
1. Same as for acoustical units.
 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 SUSPENSION SYSTEM MATERIALS

- A. Grid: ASTM C635, intermediate duty, non-fire rated exposed T; components die cut and interlocking.
- B. Accessories: Stabilizer bars, clips, splices and edge moldings required for suspended grid system.
- C. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- D. Grid Finish: Color as selected by Architect.
- E. Support Channels and Hangers: Galvanized steel; size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

2.03 ACCEPTABLE MANUFACTURERS - ACOUSTICAL UNITS

- A. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
1. Classification: ASTM E1264 Type III.
 2. Size: 24 by 24 inches.
 3. Thickness: 3/4 inch.
 4. Light Reflectance: 90 percent, determined in accordance with ASTM E1264.
 5. NRC Range: 70 to 75, determined in accordance with ASTM E1264.
 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 7. Tile Edge: Square.
 8. Color: White.
 9. Suspension System: Exposed grid.
 10. Products:
 - a. USG Corporation; Mars, Acoustical Tiles: www.usg.com/ceilings/#sle.
 - 1) Style 86185, Basis of Design.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 2. Profile: Tee; 15/16 inch face width.
 3. Finish: Baked enamel.
 4. Color: White.
 5. Products:
 - a. USG Corporation; Donn Brand ZXLA 15/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 - 1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - GENERAL

- A. Install system in accordance with manufacturer's instructions and as supplemented in this section.
- B. Install system capable of supporting imposed loads to a deflection of 1/360.
- C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- D. Hang system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels, to span the extra distance.
- F. Center system on room axis leaving equal border units according to reflected ceiling plan.
- G. Do not support components of main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6-inches of each corner; or support components independently.
- H. Do not eccentrically load system, or produce rotation of runners.
- I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.
- J. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- K. Install acoustic units level, in uniform plane, and free from twist, warp and dents.
- L. Install light fixture boxes (where required) constructed of gypsum board above light fixtures in accordance with UL assembly requirements.

3.03 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees (Maximum).

END OF SECTION 09 51 00

**SECTION 09 6519
RESILIENT TILE FLOORING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Installation accessories:
 - 1. Adhesives.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants.

1.03 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- B. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2011.
- C. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.
- D. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2018.
- E. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019.
- F. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2017.
- G. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2013a.
- H. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- I. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's documentation for flooring and accessories:
 - 1. Technical Data.
 - 2. Installation and Maintenance.
 - 3. Warranty.
 - 4. Safety Data Sheets (SDS) for accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and that the material is of the correct style, color, quantity and run number(s).
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

1.06 FIELD CONDITIONS

- A. Acclimate material at jobsite between 65 to 85 degrees F and 35 percent to 85 percent relative humidity for 48 hours prior to installation. Temperature and relative humidity should also be maintained at the same levels during installation, and after installation.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years of documented experience.

1.08 WARRANTY

- A. See Section 01 7700 - Closeout Procedures

1.09 EXTRA MATERIALS

- A. Provide 80 square feet of extra flooring material for owner.
- B. Provide 40 lineal feet of base for each material specified.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Vinyl Tile Manufacturer: Patcraft; phone 800.241.4014; www.patcraft.com
- B. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 RESILIENT TILE FLOORING

- A. Luxury Vinyl Tile: Crossover Click 1440V
 - 1. Pattern: selected from standard patterns..
 - 2. Color: as selected by Architect from standard color range..
 - 3. Physical Properties:
 - a. Construction: Phthalate-free solid plank and tile made from 100 percent virgin vinyl.
 - b. Wear Layer Thickness: 20 mil.
 - c. Total Thickness (Gauge): 0.10 inch.
 - d. Finish: Urethane coating with ceramic bead particles.
 - e. Finish: Urethane, M-Force Enhanced Urethane.
 - 4. Manufacturing, Performance, and Safety Standards:
 - a. ASTM F1700, Classification: Class III, Type B.
 - b. ASTM D2047, Coefficient of Friction (Dry): Greater than or equal to 0.6.
 - c. ASTM F970, Static Load Limit: Greater than or equal to 1,000 pounds (surpasses requirements).

2.03 ACCESSORIES

- A. Moldings, Transition and Edge Strips: Rubber.
 - 1. Product: S140V, S137V manufactured by Patcraft.
- B. Adhesives:
 - 1. Proprietary Accessory Products: Provide Altro accessories for use with Altro Lavencia Tile:
 - a. Acrylic Adhesive: Ecofix 25 for adhering flooring to substrate.
 - 2. Proprietary Product(s) Standard and Testing:
 - a. Fire Resistance: Flammability exceed minimum for Class 1 rating per ASTM E648.
 - b. Smoke Density: Less than 450 when tested in accordance with ASTM E662.
- C. Wall Base Materials:
 - 1. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set style B, Cove and as follows:
 - a. Height: 4-inch.
 - b. Thickness: 0.125 inch.
 - c. Finish: Satin.
 - d. Color: As selected from manufacturer's standard range.
 - e. Accessories: Premolded external corners and end stops.

PART 3 EXECUTION**3.01 EXAMINATION - SEE ALSO SECTION 01 7000.**

- A. Install flooring and accessories after other operations (including painting) have been completed.
- B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.
 - 1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.
- C. Verify that substrate is contaminant-free, including old adhesives and abatement chemicals.
- D. Test substrates as required by manufacturer to verify proper conditions exist.
 - 1. Concrete:
 - a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
 - b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
 - c. Perform alkalinity testing per ASTM F710 to verify pH level is between 7 to 10.
 - d. Check substrate for absorbency per manufacturer's recommendations.
 - e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.
- B. Prepare per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Concrete Substrates: Prepare substrate per ASTM F710.
 - a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
 - b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
 - 1) Do not use solvents or adhesive removers.
 - c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.
 - d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or calcium aluminate based patching or underlayment compound for filling or smoothing, or both.
 - 1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.
 - 2) Sand smooth per manufacturer's instructions.
 - e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.
 - f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.
 - g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M.

- h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.

3.03 INSTALLATION

- A. Installation per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Layout shall be specified by Architect, Designer or End User.
 - 2. Follow layout and ensure installation reference lines are square.
 - 3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.
 - 4. Check cartons for and do not mix dye lots.
 - 5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
 - a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
 - b. Install movement joint systems per manufacturer's instructions and per Section 07 9200.
 - 6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
 - a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
 - b. Periodically spot-check transfer of adhesive to back of tile during installation.
 - c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
 - d. Protect floor from traffic per manufacturer's instructions.
 - e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.04 FIELD QUALITY CONTROL

- A. Site tests and inspections:
 - 1. Inspect flooring installation for non-conforming work including (but not limited to) the following:
 - a. Lack of adhesion.
 - b. Bubbles, loose tiles or raised edges.
 - c. Dirt and debris underneath flooring.
 - d. Excessive gaps.
 - e. Improper substrate preparation (as indicated by telegraphing).
 - f. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.
- B. Non-conforming work per General Conditions and as follows:
 - 1. Repair or replace damaged material if not acceptable to the Architect.

3.05 CLEANING

- A. Waste Management per Section 01 7000, and as follows:
 - 1. Coordinate material reclamation program with manufacturer, if applicable.
 - a. Store and return cartons and pallets to manufacturer or recycler for reuse or recycling.
- B. Provide progress cleaning per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.
 - a. Clean and protect completed construction until Date of Substantial Completion.
 - b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.
 - 2. Site: Maintain project site free of waste materials and debris.
- C. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's written instructions and Section 01 7000.

1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of Substantial Completion inspection, unless required otherwise.
2. Clean floor with a neutral 6-8 pH cleaner.

3.06 PROTECTION

- A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.
 1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.
 2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
 3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
 4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION

**SECTION 09 6566
RESILIENT ATHLETIC FLOORING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Rubber tile, adhesively installed.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016.
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015e1.
- C. SCS (CPD) - SCS Certified Products; Current Edition.
- D. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, layout, and colors.
- D. Selection Samples: Manufacturer's color charts for flooring materials specified indicating full range of colors and textures available.
- E. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.07 FIELD CONDITIONS

- A. Maintain temperature at service levels and/or the ambient temperature must remain steady ($\pm 10^{\circ}$ F) between 65° F and 85° F for at least 48-hours prior to, during and until substantial completion.
- B. Maintain relative humidity at service levels, or between 40% and 65% RH.
- C. Avoid conditions in which dew point causes condensation on the installation surface.

1.08 EXTRA MATERIALS

- A. Provide 60 square feet of extra flooring material for owner.
- B. Provide 40 lineal feet of base for each material specified.

PART 2 PRODUCTS**2.01 PREFORMED ATHLETIC FLOORING**

- A. Rubber Tile Flooring: Recycled vulcanized rubber and colored granules.

1. Thickness: Minimum 3/8 inch.
2. Tile Edge/Installation: Straight, adhesive installation.
3. Size, Straight Edge Tile: Nominal 27 inches by 27 inches.
4. Durometer Hardness, Type A: Minimum of 70, when tested in accordance with ASTM D2240.
5. Free of tire derived crumb rubber.
6. Surface Texture: Smooth.
7. Color: As selected from manufacturer's standard range.
8. Products:
 - a. Roppe. Tuflex Spartus
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 ACCESSORIES

- A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.
- C. Transition: Roppe #74 Rubber rolling transition.
 1. Color: Selected by architect from standard selection.
- D. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove and as follows:
 1. Height: 4-inches.
 2. Thickness: 0.125 inch.
 3. Finish: Satin.
 4. Color: As selected from manufacturer's standard range.
 5. Accessories: Premolded external corners and end stops.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.
- B. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.
- C. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Rubber Tile Flooring:

1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Spread only enough adhesive to permit installation of materials before initial set.

3.04 CLEANING

- A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

- A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

**SECTION 09 6813
TILE CARPETING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2017.
- D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Submit two, 12" inch long samples of edge strip and base cap.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - PRODUCT REQUIREMENTS, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Patcraft:(800) 241-4014 / www.patcraft.com.
- B. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MATERIALS

- A. Tile Carpeting: Tufted Patterned Loop.

1. Collection: Infrastructure.
2. Tile Size: 24 x 24 inch, nominal.
3. Color: To be selected by Owner from manufacturer's full range.
4. Pattern: Formwork, Scaffold or Transverse - to be selected by owner...
5. Gage: 1/12
6. Stitches: 12 per inch.
7. Tufted Pile Height: 3/32" low - 5/32" high.
8. Tufted Yarn Weight: 17 oz.
9. Finished Pile Thickness: .107"
10. Density: 7,846.
11. Fiber: EcoSolution Q Nylon.
12. Primary Backing Material: Non-Woven Synthetic.
13. Secondary Backing Material: EcoWorx Tile.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, color as selected by Architect.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

- F. Trim carpet tile neatly at walls and around interruptions.
- G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

NOT FOR BID

**SECTION 09 7200
WALL COVERINGS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Surface preparation and prime painting.
- B. Wall covering.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, 8 by 10 inch in size illustrating color, finish, and texture.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

PART 2 PRODUCTS**2.01 WALL COVERINGS**

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
- B. Wall Covering: Fabric-backed vinyl roll stock.
 - 1. Basis of Design; MDC Dreamscape - with digital image
 - a. Quantity of one digital images.
 - b. Verify size required, location indicated on plan.
 - 2. Total Thickness: - mil (.018-.026 inch).
 - 3. Thickness: 0.017 to 0.027
 - 4. Total Weight: 20 oz/sq yd.
 - 5. Roll Width: 54-60 inches.
 - 6. Backing: Woven, osnaburg fabric.
 - 7. Surface Texture: Smooth Matte.
 - 8. Manufacturers:
 - a. MDC Wallcoverings; -: www.mdcwall.com/#sle.
 - b. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. Substrate Primer and Sealer: Alkyd enamel type.

- D. Digital Image: Owner / Architect to provide JPEG files of images to be digitally printed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.
- D. Verify size of wall cover required at each location so that image is provided at correct scale.

3.02 PREPARATION

- A. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- C. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- D. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Use wall covering in roll number sequence.
- D. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- E. Butt edges tightly.
- F. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- G. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- H. Do not install wall covering more than 1/4 inch below top of resilient base.
- I. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

**SECTION 09 9113
EXTERIOR PAINTING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Mechanical and Electrical:
 - a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other types of tiles.
 - 9. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 10. Glass.
 - 11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 05 5100 - Metal Stairs: Shop-primed items.
- C. Section 09 9123 - Interior Painting.
- D. Section 22 0553 - Identification for Plumbing Piping and Equipment: Painted identification.
- E. Section 23 0553 - Identification for HVAC Piping and Equipment: Painted identification.
- F. Section 26 0553 - Identification for Electrical Systems: Painted identification.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2016.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 3. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, submit each color in each sheen available.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
 - 1. Sherwin-Williams Company; -: www.sherwin-williams.com/#sle.
 - 2. Vista Paint
 - 3. Dunn Edwards; www.dunnedwards.com.
- C. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: As indicated on drawings.
1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
 2. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the to match wall and ceiling color.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, fiber cement siding, primed wood, and primed metal.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Pigmented Elastomeric, Water Based.
- B. Concrete Floors and Wood Decks to be Painted.
1. Two top coats and one coat primer.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer.
 2. Interior/Exterior Latex Block Filler.
 3. Alkyd Primer for Galvanized Metal.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Exterior Plaster and Stucco: 12 percent.

2. Fiber Cement Siding: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
 1. 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.
- G. Masonry:
 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
- H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.
- J. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- K. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- L. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- M. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- N. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- O. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

- Q. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.
- R. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.06 SCHEDULE - PAINT SYSTEMS

- A. Concrete, Concrete Masonry Units (CMU), Concrete Block, Brick Masonry: Finish surfaces exposed to view.
 - 1. One coat block primer. Vista Paint 018 100% Acrylic Block Filler.
 - 2. One coat primer sealer latex. Vista Paint 4600 Uniprime II.
 - 3. One coat latex paint. Vista Paint 3000 Acribond.
- B. Exterior Plaster: Finish surfaces exposed to view.
 - 1. One coat Vista Paint 4600 Uniprime II.
 - 2. Two coats Vista Paint 500 Solotex-100% Acrylic Elastomeric Finish
- C. Fiber Cement Siding: Finish surfaces exposed to view, except _____.
- D. Wood: Finish surfaces exposed to view.
- E. Wood - Transparent:
 - 1. One coat stain. Olympic Stain, Semi-Transparent.
 - 2. One coat sealer. As directed.
- F. Galvanized Steel: Finish surfaces exposed to view, except _____.
 - 1. Pretreatment: Jasco Prep N Prime.
 - 2. One coat zinc chromate primer. Vista Paint 4800 Metal Pro or Carbozinc 90.
 - 3. Two coats acrylic enamel, semi-gloss. Vista Paint 8400 Semi-Gloss or 7900 Premogloss or Carboline 133 VOC.
- G. Steel - Unprimed:
 - 1. One coat zinc chromate primer. Vista Paint 4800 Metal Pro or Carbomastic 90.
 - 2. Two coats acrylic enamel semi-gloss. Vista Paint 8400 Semi-Gloss or 7900 Premogloss or Carboline 133 VOC.

H. Steel - Shop Primed:

1. Touch-up with zinc chromate primer. Vista Paint 4800 Metal Pro or Carbozinc 90.
2. Two coats alkyd enamel semi-gloss. Vista Paint 8400 Semi-Gloss or 7900 Premogloss or Carboline 133 VOC.

I. Pavement Markings:

1. "Laycold Line Paint" or Vista Paint 6900 On-Line Traffic Marking Paint.

END OF SECTION

NOT FOR BID

**SECTION 09 9123
INTERIOR PAINTING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Elevator pit ladders.
 - 3. Prime surfaces to receive wall coverings.
 - 4. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint dampers exposed behind louvers, grilles, and convectors and baseboard cabinets to match face panels.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 09 9113 - Exterior Painting.
- C. Section 09 9600 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2016.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- G. SSPC-SP 13 - Surface Preparation of Concrete; 1997 (Reaffirmed 2003).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - PRODUCT REQUIREMENTS, for additional provisions.
 - 2. Extra Paint and Finish Materials: 3 gallons of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 2. Vista Paint: www.vistapaint.com.
 - 3. Dunn Edwards; www.dunnedwards.com.
- C. Transparent Finishes:
 - 1. Vista Paint: www.vistapaint.com.
 - 2. Minwax: www.minwax.com.
- D. Primer Sealers: Same manufacturer as top coats.
- E. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - c. Architectural coatings VOC limits of the State in which the Project is located.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: As indicated in Color Schedule.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
 - 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen as indicated in drawings.
 - b. Semi-Gloss: MPI gloss level 5; use this sheen as indicated in drawings.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 - 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): Interior Alkyd, Water Based; MPI #157, 167, 168, or 169.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd, Semi-Gloss.
 - 2) Vista Paint 8400 Carefree Semi-gloss -.
 - 3) Substitutions: Section 01 6000 - PRODUCT REQUIREMENTS.
 - 4. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Alkyd, Water Based.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd, Eg-Shel.

- 2) Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd, Gloss.
 - 3) Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd, Semi-Gloss.
 - 4) Substitutions: Section 01 6000 - PRODUCT REQUIREMENTS.
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
1. Shop primer by others.
 2. One top coat -.
 3. Top Coat: Alkyd Dry Fall.
 - a. Products:
 - 1) Sherwin-Williams Super Save-Lite Dryfall, Gloss VOC Complying.
 - 2) Substitutions: Section 01 6000 - PRODUCT REQUIREMENTS.
 4. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 5. Primer: As recommended by top coat manufacturer for specific substrate.
- E. Paint I-OP-FL - Concrete and Wood Floors to be Painted.
1. Two top coats and one coat primer.
 2. Top Coat(s): Latex Floor Paint, Low Gloss.
 - a. Products:
 - 1) Sherwin-Williams Tread-Plex Acrylic Floor Coating. (MPI #60)
 - 2) Substitutions: Section 01 6000 - PRODUCT REQUIREMENTS.
 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
 2. Interior/Exterior Latex Block Filler; MPI #4.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
 2. Plaster and Stucco: 12 percent.
 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
 - 1. 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.
 - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- F. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
 - 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- G. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- M. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- N. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- O. Wood Floors: Sand floor and remove any grease or dirt.
- P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishin

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.
- C. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- D. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- E. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting procedures.

3.07 SCHEDULE - PAINT SYSTEMS

- A. Wood - Painted:
 - 1. One coat alkyd prime sealer. Vista Paint 6600 Aqua Lac.
 - 2. Two coats latex, eggshell. Vista Paint 8300 Carefree Eggshell.
- B. Wood - Transparent:
 - 1. Filler coat (for open grained wood only).
 - 2. One coat stain. VWS Series.
 - 3. One coat sealer. Valspar NAS 1820.
 - 4. One coat varnish satin. Valspar NAS 1822.
- C. Wood - Transparent - Floor
 - 1. Two-Three coat sealer:. Minwax Ultra Fast Drying Polyurethane for Floors, Satin finish.
- D. Concrete:
 - 1. One coat block filler. Vista Paint 018 100% Acrylic Block Filler.
 - 2. One coat primer sealer latex. Vista Paint 4600 Uniprime II
 - 3. One coat latex, eggshell. Vista Paint 8300 Carefree Eggshell.
- E. Steel - Unprimed:
 - 1. One coat zinc chromate primer. Vista Paint 4800 Metal Pro.

2. Two coats semi-gloss. Vista Paint 8400 Carefree Semi-Gloss or Rust-Oleum Sierra S70 or S71 Primer and Rust-Oleum Sierra S22 Finish.
- F. Steel - Primed:
1. Touch-up with original primer. Vista Paint 4800 Metal Pro.
 2. Two coats semi-gloss. Vista Paint 8400 Carefree Semi-Gloss or Rust Oleum Sierra S70 or S71 Primer and Rust-Oleum Sierra S22 Finish.
- G. Steel - Galvanized:
1. Pretreatment: Jasco Prep N Prime.
 2. One coat zinc chromate primer. Vista Paint 4800 Metal Pro.
 3. Two coats semi-gloss. Vista Paint 8400 Carefree Semi-Gloss or Rust-Oleum Sierra S70 or S71 Primer and Rust-Oleum Sierra S22 Finish.
- H. Plaster, Gypsum Board
1. One coat alkyd primer sealer. Vista Paint 1100 High Build PVA.
 2. Two coats alkyd enamel, eggshell. Vista Paint 8300 Carefree Eggshell.

END OF SECTION

**SECTION 09 9623
ANTI GRAFFITI COATING SYSTEM**

PART 1 GENERAL**1.01 SUMMARY:**

- A. Description: This Section includes the application of an anti-graffiti coating system to protect the above-grade exterior surfaces including, but not limited to:
 - 1. Stained or "specially finished" concrete (as indicated on elevations)
 - 2. CMU walls (as indicated on elevations)
- B. Coatings: As used herein, means all graffiti resistant coating system materials, including base coatings and top coating required to achieve the performance requirements of this Section
 - 1. Clear (transparent) graffiti resistant coating.

1.02 SECTION INCLUDES:

- A. Section 033100 - Cast-In-Place Concrete
- B. Section 042200 - Unit Masonry

1.03 REFERENCES:

- A. Coatings must comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 VOC limits. OR RULE 1113 IS THE APPLICABLE SCAQMD RULE RE ARCHITECTURAL COATINGS AND IS PROBABLY MORE APPROPRIATE UNLESS SOME SPECIAL NEED TO REFER TO ADHESIVES AND SEALANTS.
- B. ASTM D2369-92 - Test methods for Volatile Contents of Coatings.
- C. ASTM D3960-93 - Practice for Volatile Organic Compounds (VOC) Contents of Paints and Related Coatings.
- D. ASTM B-1 17 and ASTM D-714 (Salt spray Test): 10,000 Hours.
- E. ASTM D-522 (Flexibility Strength Test): Pass 3/8" mandrel.
- F. ASTM D-968 (Abrasion Test): 10 liters of sand to abrade 1 mil of dry coating.
- G. Test): Vapor is transmitted.
- H. ASTM D-3359-90 (Adhesion Test): 5A
- I. ASTM D-610-85 (Rust): Less than 0.03% degradation.
- J. SCAQMD - Rule 1168

1.04 SYSTEM DESCRIPTION

- A. Base coating and graffiti resistant top coating shall each be a permanent coating system.
- B. Product shall be suited to architectural aesthetics of substrate and shall come in clear or color with a choice of finishes including dead flat, semigloss, or high gloss.
 - 1. Finishes must be measurable on a 60 degree meter to read not greater than:
 - a. 5 flat finishes
 - b. 45 to 55 for semigloss finishes
 - c. not less than 75 for high gloss finishes
- C. Anti-graffiti coating shall show no signs of deterioration or change of appearance after graffiti has been removed during the 20-year warranty period: i.e., no shadowing, ghosting, or staining of coating or substrate.
- D. Anti-graffiti coating shall be non-yellowing, non-chalking, and UV resistant S. Graffiti removal product shall be non-toxic, non-flammable, biodegradable, and with a neutral pH with a range between 7.0 and 8.5.
- E. Anti-graffiti coatings shall be AQMD/VOC compliant.

1.05 SUBMITTALS

- A. Product data: Submit manufacturer's product data sheets on products to be used for the Work.
 - 1. Base Coating.
 - 2. Anti-graffiti top coating.
 - 3. Graffiti removal agent.
- B. Applicator Qualifications
 - 1. Manufacturer's certification or pre-training letter approving of applicator or willingness to train applicator if awarded sub-contract for this anti-graffiti portion of the work.

1.06 MOCK-UP TEST PANEL

- A. Apply base coating and graffiti resistant top coating to test areas to determine number of coats, coverage rates, compatibility, effectiveness, surface preparation, application procedures, and desired results.
- B. Test Panel Requirements:
 - 1. Area: Minimum 4 feet by 4 feet.
 - 2. Locations: As determined by Owner
 - 3. Each type of substrate that will be protected

1.07 QUALITY ASSURANCE

- A. Applicator
 - 1. Applicator shall be experienced in coating applications, and shall be currently a Certified Applicator in Good Standing and/or will become certified per the Manufacturer's training procedures during the project with the graffiti resistant coatings as specified in this section.
- B. Pre-Application Meeting: Convene a pre-application meeting before the start of application of graffiti resistant coating. Require attendance of parties directly affecting Work of this Section, Including the General Contractor, Owner, Certified Applicator, and Manufacturer's Representative. Review environmental regulations, test panel procedures, protection of the surrounding areas and non-masonry surfaces, surface preparation, application, field quality control, final cleaning, and coordination with other Work.
- C. Single Source Responsibility: Same manufacturer will supply base coatings, top coatings and all removal agents.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, bearing manufacturer's name label with the following information:
 - 1. Name of the material.
 - 2. Manufacturer's stock number and date of manufacture.
 - 3. Manufacturer's name.
 - 4. Contents by volume for major pigment and vehicle constituents.
 - 5. Application instructions.
- B. Protect from freezing where necessary. Keep storage area neat and orderly. Remove flammable rags and waste daily. Take precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of coatings.

1.09 PROJECT/SITE CONDITIONS

- A. Temperature Limitations:
 - 1. Apply water-based coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 degrees F and 95 degrees F, unless permitted by paint manufacturer's printed Instructions.
 - 2. Apply solvent-based coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 degrees F and 95 degrees F, unless permitted by paint manufacturer's printed instructions
- B. Apply per manufacturer's Instructions.

- C. Do not apply under windy conditions such that base coating and/or graffiti resistant coating may be blown to surfaces not other than those being treated.
- D. Do not apply earlier than 24 hours after rain, snow, fog, or mist if same is predicted for a period of 12 hours after application.
- E. This specification, the manufacturer's specifications, and MSDS sheets are to be on the job site during application. Applicators shall be thoroughly familiar with their content.

1.10 WARRANTY

- A. Warranty shall cover the original purchaser or property owner for a period of twenty (20) years from the date of Grand Opening.
- B. Manufacturer shall warrant the performance for its products for the warranty period and the removal of graffiti defacement, chemical staining, ghosting, shadowing and normal environmental effects, without exception, and shall retain reasonable gloss and color stability so long as product is applied according to the manufacturer's recommendations. Warranty shall be issued only upon successful application of the products and verification that products were properly applied by showing successful graffiti removal. Once warranty is issued, manufacturer will bear responsibility for repair, remediation of any substrate and replacement of coatings if there is a failure of the products to protect the substrates and the coatings from damage from graffiti. Manufacturer shall not be responsible for water conditions, structural defects, damage to coatings from external forces, or similar causes.

1.11 INSTRUCTIONS

- A. Subcontractor shall provide demonstration of cleaning procedure per manufacturer's Instructions to tenant's or property owner's representative after completion of application and surface has properly cured. Owner will coordinate the meeting.

1.12 MAINTANENCE

- A. Extra Products: Furnish the following extra products: Graffiti removal agent -- One and one-half (1.5) gallons per 2,500 square feet of covered area. GSS TYPICALLY PACKAGES IN A SINGLE CASE – TWELVE 16oz. bottles which equals 1.5 gallons.
 - 1. Removal agent shall be packaged in 16 to 32 oz. bottles and boxed for storage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Graffiti resistant coating shall be a clear, non-sacrificial graffiti resistant coating which provides protection for exterior vertical surfaces from permanent graffiti staining and damage caused by any type of commercially available spray or other paint, stains, inks, and marking pens.
Coating shall be suitable for application to painted and unpainted surfaces including masonry, concrete, metals, and EIFS. Product shall be a coating that dries clear, non-yellowing, non-chalking with a sheen of <5° on the Gardner Gloss Meter for flat finish top coats.
 - 1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following products as manufactured by GSS Coatings, LLC, South Jordan, UT; 801-255-9505. www.gsscoatings.com . or approved equal (any submittals for alternates must be made and approved prior to bid).
 - a. Base Coat: GSS-307 Base Coat
 - b. Top Coat: GSS-100 Top Coat or other related top coats depending on required sheen and/or tint.
 - c. Cleaning Solution: GSS-400 ERASOL Graffiti Cleaning Solution
- B. Water Repellant (For first coat on unpainted concrete and masonry surfaces): GSS-500 Aqua-Lock WB Water Repellent & Concrete Sealer.

2.02 MATERIAL CHARACTERISTICS

- A. Anti-graffiti coatings shall be multi-component, multi-coat coating system. Single component systems are not acceptable.

- B. Anti-graffiti coating shall not contain paraffin (wax) or elastomeric silicones.
- C. Anti-graffiti coating shall have the capability of having all types of paints and graffiti materials (currently known to the general public) completely removed without damaging the anti-graffiti top coating, the base coating or the substrate.
- D. Removal agent shall be non-toxic, non-flammable, biodegradable, and have a pH 7 to 8.5. After removal is complete, no evidence of graffiti shall be present.
- E. The removal of graffiti material shall not cause a change in the appearance of the treated surface for the period of the warranty; i.e., there shall be no shadowing, ghosting, or staining of coating or substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Applicator shall examine areas and conditions under which anti-graffiti coating is to be applied. Applicator shall notify General Contractor and Owner in writing of conditions detrimental to proper and timely completion. Applicator to ensure that any acidic cleaner has been removed and that substrates to be treated are free of contaminants and are pH neutral prior to application of anti-graffiti coatings. Applicator shall not proceed with Work until unsatisfactory conditions have been corrected.
- B. Commencement of coating work shall be construed as Applicator's acceptance of surfaces and conditions within any particular area and Applicator's representation that the surface has been properly treated, cleaned, or repainted.
- C. Unpainted Concrete and Masonry: Verify water repellant has been applied in accordance with Section 071900 to new or non-painted concrete and masonry surfaces prior to the application of the anti-graffiti coating.
- D. Do not apply over dirt, rust scale, grease, moisture, or conditions otherwise detrimental to formation of a durable base coating

3.02 PREPARATION

- A. General: Perform preparation and cleaning procedures with coating manufacturer's instruction and as herein specified for each particular substrate condition.
- B. Repair, patch, and fill cracks, voids. Defects and damaged areas in surface as approved by the Owner.
- C. Allow repair materials to cure completely before application of graffiti resistant coatings.
- D. Apply specified sealant and caulking and allow to each cure completely before application of graffiti resistant coatings.
- E. Seal all open joints with sealant approved for substrate and acceptable by coatings manufacturer.
- F. Allow masonry, concrete construction and repainted surfaces to cure completely before applying graffiti resistant coatings.

3.03 APPLICATION

- A. General: Apply anti-graffiti coating in accordance with manufacturer's directions. Use application techniques best suited for substrate and type of material to be applied.
- B. Applicator shall know the substrate that is to be coated and understand the porosity, texture, and general conditions that will be present during the application to provide a correct bid and choose correct product acquisition. Applicator responsible for ensuring that correct wet and dry mil thicknesses achieved as per manufacturer's specifications.
- C. Do not dilute anti-graffiti products, materials shall be used direct from the manufacturer's containers.
- D. Mix anti-graffiti coatings two-component products at ratio stated by the manufacturer.

- E. Applicator shall use caution when spraying coatings. Applicator shall wear a respirator with an organic vapor cartridge. Avoid over-spray and spillage. Mask all windows, move vehicles, cover air intakes, cover vegetation, place barriers to keep pedestrians away from the spraying materials. Applicator shall make sure there is adequate ventilation. Applicator should use an air line respirator if ventilation is not adequate.
- F. Do not apply in windy conditions.

3.04 APPLICATION RATES

- A. Base Coatings:
 - 1. All base coatings require an application of at least two (2) coats on all surfaces. If two (2) coat does not result in a continuous, pin-hole free coating, additional coats must be applied until a pin-hole free surface is achieved.
 - 2. Allow a minimum of 24 hours between base coatings and anti-graffiti top coating.
 - 3. Anti-graffiti top coatings require an application of at least two (2) coat on all surfaces. (With the exception of split face block. Please contact manufacturer.) Dry mil thickness of 3.5-4 anti-graffiti top coating must be achieved per manufacturer's specifications.
- B. Apply at 3.5 - 4.0 mils dry (7.0 - 8.0 mils wet) per coat to achieve optimal performance.
- C. Apply coatings in a crosshatch pattern. One vertical pass and one horizontal pass are considered one coat.
- D. Back roll base coating when applying to an uneven or textured substrate to achieve a continuous pinhole free surface.
- E. Top coating may not require back rolling. Consult with manufacturer.

3.05 FIELD QUALITY CONTROL

- A. Inspection: Inspect the graffiti resistant coatings Work with the General Contractor, Owner, and Applicator and compare with test panel results accepted by the Owner. Subcontractor to comply with manufacturer's requirements for issuance of warranty.
- B. Touch-up Work: Surface areas determined to be un-coated or not consistent with desired finish shall be repaired per manufacturer's written instruction.
- C. Manufacturer's Field Services: Provide the services of a manufacturer's authorized representative to verify specified products are used, and protection, surface preparation, and application of graffiti resistant coatings are in accordance with the manufacturer's written instructions and the test panel results accepted by the Owner.

3.06 CLEANING

- A. Clean site of all unused graffiti resistant coatings, residues, rinse water wastes, and effluent in accordance with environmental regulations.
- B. Remove and dispose of all materials used to protect surrounding areas and non-masonry surfaces, following completion of the Work of this Section.
- C. Repair, restore, or replace to the satisfaction of the, all materials, landscaping, and non-masonry surfaces damaged by exposure to graffiti resistant coatings.

END OF SECTION

**SECTION 10 1400
SIGNAGE****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Room and door signs.
- B. Building identification signs.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
 - 1. Provide engineered shop drawings for letters mounted on top of Entry Canopy.
- C. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- E. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Flat Signs:
 - 1. Best Sign Systems, Inc; -: www.bestsigns.com/#sle.
 - 2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com/#sle.
 - 3. Inpro; -: www.inprocorp.com/#sle.
 - 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Dimensional Letter Signs:
 - 1. Gemini Signs, Inc.
 - 2. Cosco Industries: www.coscoarchitecturalsigns.com/#sle.
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1CBC 2019, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with - panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 1 inch.
 - 4. Sign Height: 2 inches, unless otherwise indicated.
 - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
 - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 8. Rest Rooms: Identify with pictograms, the names "ALL-GENDER RESTROOM", and braille.
- C. Building Identification Signs:
 - 1. Use individual metal letters.
 - 2. Mount on outside wall in location indicated on drawings.

2.03 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Square.
 - 3. Wall Mounting of One-Sided Signs: Concealed or exposed screws.
 - 4. Door Mounted: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: Clear.
 - 4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
 - 1. Total Thickness: 1/8 inch.
- B. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.
 - 1. Total Thickness: 1/8 inch.
- C. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
 - 1. Total Thickness: 1/4 inch.
 - 2. Letter Thickness: 1/8 inch.
 - 3. Letter Edges: Square.

2.05 DIMENSIONAL LETTERS

- A. Metal Letters:
 - 1. Metal: Bronze casting.
 - 2. Metal Thickness: 1/8 inch minimum.
 - 3. Depth: 1/2 inch min.
 - 4. Letter Height: As Indicated
 - 5. Text and Typeface:

- a. Character Font: Avant Gard.
 - b. Character Case: Upper case only.
6. Finish: Baked Enamel.
7. Mounting: Concealed screws.
- B. Metal Letters:
 1. Flat Cut Metal: Aluminum, 5052 Alloy/5083 Alloy.
 2. Finish: Baked Enamel, bead blast returns, sprayed with acrylic polyurethane, baked.
 3. Mounting: Stud mounted per engineering requirements for site location and weather conditions.
 4. Text and Typeface:
 - a. Character Font: Avant Gard
 - b. Character Case: Upper case only

2.06 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Exposed Screws: Stainless steel.
- C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs where indicated:
 1. If no location is indicated obtain Owner's instructions.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

**SECTION 10 2600
WALL AND DOOR PROTECTION**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Corner guards.
- B. Protective wall covering.
- C. Metal wall panels

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.
- B. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions and features.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Corner Guards:
 - 1. Inpro; -: www.inprocorp.com
 - 2. Pawling Corp. www.pawling.com/#sle.
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Protective Wall Covering:
 - 1. Inpro; -: www.inprocorp.com/#sle.
 - 2. Pawling Corp; -: www.pawling.com/#sle.
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 PRODUCT TYPES

- A. Corner Guards: Type 1-Surface Mounted
 - 1. Material: High impact vinylwith full height vinyl retainer.
 - a. Basis of Design: BullNose High Impact Corner Guard, Manuf. Inpro Corp. 0.080 thk
 - 2. Width of Wings: 2 inches.
 - 3. Corner: Square.
 - 4. Color: As selected from manufacturer's standard colors.
 - 5. Length: One piece.
- B. Corner Guards: Type 2 -Surface Mounted: Stainless Steel, screw attached
 - 1. Material: 304, 16 ga.
 - 2. Width of wings: 3 inches min.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to 4' inches high.

3.03 SCHEDULE

- A. Living quarters, Offices: Type 1 Corner guards.
- B. Apparatus #2: Type 2 Corner guards.

END OF SECTION

NOT FOR BID

**SECTION 10 2800
TOILET AND BATH ACCESSORIES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Attachment hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000: Rough Framing, concealed supports for accessories, including in wall framing and plates.
- B. Section 08 8000 - Glazing: Wall mirrors.

1.03 REFERENCE STANDARDS

- A. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; '08.
- B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability, Solution Hardened and Bake Hardenable; '09.
- C. ASTM B456/ASTM B456M - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; '03.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- E. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Submit manufacturer's installation instructions.

1.05 KEYING

- A. Supply 4 keys for each accessory to Owner.
- B. Master key all accessories.

1.06 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Substitutions and Product Options: Under provisions of Section 01 60 00 - "Product Requirements".
- B. Commercial Toilet, Shower, and Bath Accessories:
 - 1. Bobrick
 - 2. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 3. Bradley Corporation: www.bradleycorp.com/#sle.

C. Shower Receptors:

1. Florestone: www.florestone.com, Ph 800.446.8827.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Sheet Steel: ASTM A1008/A1008M.
- C. Stainless Steel Sheet: ASTM A167, Type 304.
- D. Tubing: ASTM A269, stainless steel.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.
- E. Shop assemble components and package complete with anchors and fittings
- F. Provide steel anchor plates, adapters, and anchor components for installation.
- G. Hot dip galvanize exposed and painted ferrous metal and fastening devices.

2.04 FACTORY FINISHING

- A. Galvanizing: ASTM A123.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- D. Stainless Steel: No. 4 satin luster finish.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Terrazzo Shower Receptor:
 1. Florestone
 - a. Model 200 recess.
 - b. Size: 36" x 42".
 - c. For use in Living Quarters' bathrooms.
 2. Florestone
 - a. Model 200 recess
 - b. Size: 42" x 36"
 - c. For use in Apparatus Bay Showers
- B. Shower Door:
 1. Manufacture: Century Shower Doors, 20100 Normandie Ave., Torrance CA 90502
Ph: (800) 824-9350, www.showerdoor.com.
 2. Model #1000 SL.
 - a. Standard Features:
 - 1) Metal Finishes - Silver.
 - 2) Glass - safety tempered, clear.
 - 3) Highly buffed, premium weight aluminum framing.
 - 4) "Easy-clean", L-shaped track.

- 5) Size to fit opening. Min. door opening 30".
- 6) Provide side panel where indicated in plans.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 1. Grab Bars: As indicated on drawings.

3.04 SCHEDULE

- A. Toilet Paper Dispenser: Bobrick #B-6857 or as approved by the Architect. Satin finish.
- B. Toilet Seat Cover Dispenser: Bobrick B-4221 Stainless steel satin finish.
- C. Surface Mounted Paper Towel Dispenser: Bobrick #B-4262, dispenses 400 C-fold or 525 Multi-fold paper towels, stainless steel satin finish cabinet.
- D. Grab Bars: ASI or Bobrick, or as approved by Architect, 1-1/4-inch round section, forged brass, concealed fastenings, polished chrome finish. ASI #3100, Series B-5806, 18-inches, 36-inches and 42-inches.
- E. Robe Hooks: ASI #7345, Bobrick #B-7672, double robe hook, bright stainless steel finish, or as approved by Architect.
- F. Towel Bars: (24-inches & 30-inches - see interior elevations and Reference Plan). ASI #7360, Bobrick B-205 Series, Heavy duty towel bar, stainless steel satin finish, or as approved by Architect.
- G. Soap Dispenser: Bobrick #B-2111, surface mounted soap dispenser. Vertical tank is satin-finish stainless steel. Capacity - 40 fl. oz.
 1. Only in accessible restroom.
- H. Recessed Soap Dish: Bobrick #B-4380, (7-3/16" W x 5" H) Type 304 stainless steel recessed heavy-duty soap dish or as approved by Architect. .
- I. Mirror:
 1. Bobrick #B-290 2436 Channel Framed Mirror.
 - a. Type 304 satin-finish stainless steel shelf.
 - b. For use above wall mounted lavatory.
 2. Mirror with D645, CRL Polished Finish 1/4" deep nose, "J" channel trim as distributed by CR Laurence, Co., Inc. Field Verify Sizes.
 - a. 36 inch W x 44 inch H
 - b. For use above bathroom casework.
- J. Folding Shower Seat: Bobrick #B5191
 1. Seat — One-piece, 5/16" (8mm) thick, solidly fused plastic laminate with matte-finish melamine surfaces,

2. Frame — 18-8, Type-304, stainless steel with satin finish. 16-gauge (1.6mm), 1-1/4" (30mm) square tubing and 18-gauge dia. tubing

END OF SECTION

NOT FOR BID

**SECTION 10 4116
RAPID ENTRY SYSTEM****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Rapid Entry System (Key Lock Box).

1.02 REFERENCE STANDARDS

- A. Federal Specification TT-C-490D - Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings, '93.
- B. UL - Underwriters Laboratories, Inc.

1.03 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide manufacturer's product information, including installation instructions.

1.04 QUALITY ASSURANCE

- A. Final acceptance will be contingent upon compliance with Fire Department requirements.
- B.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. KNOX-BOX, 3200 Series, with hinged door, recessed with optional alarm tamper switch.
 - 1. Lock: UL listed. Double-action rotating tumblers and hardened steel.
 - 2. Finish: Pre-treatment, zinc-phosphate to Federal Standard TT-C-490D Type II.
 - a. Final coating - weather resistant interior and exterior TGIC polyester powder coat.
 - b. Color: As selected by Architect.
 - c.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and as approved by the Fire Department.

END OF SECTION 10 41 16

**SECTION 10 4400
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS**1.03 REFERENCE STANDARDS**

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
 - 1. Potter-Roemer: www.potterroemer.com/#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Clear Vu Series: www.activarcp.com/#sle. Basis of Design.
 - 2. Potter-Roemer; -: www.potterroemer.com.
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 5 pound.
 - 3. Temperature range: Minus 65 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
 - 1. Formed galvanized steel sheet; 0.036 inch thick base metal.
- C. Cabinet Configuration: Semi-recessed type.
 - 1. Size to accommodate accessories.
 - 2. Trim: Flat square edge, with 1-1/4 inch wide face.
- D. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- E. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, full view bubble shape and set in resilient channel glazing gasket.
- F. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

1. Exterior of building and in Apparatus 1 and 2: Provide stainless steel finish.
2. Interior FE Cabinets: Finish to be Powder Coated steel, color white.

2.04 ACCESSORIES

- A. Cabinet Signage: As required by local fire department.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, at height indicated.
- C. Place extinguishers in cabinets.

END OF SECTION

**SECTION 10 5126
PLASTIC LOCKERS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Solid plastic lockers.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking and nailers.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Solid Plastic Lockers:
 - 1. Scranton Products; Tufftec Lockers: www.scrantonproducts.com/#sle.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 LOCKER APPLICATIONS

- A. Student Lockers: Solid plastic lockers, wall mounted with matching closed base.
 - 1. Width: 15 inches.
 - 2. Depth: 12 inches.
 - 3. Height: 72 inches.
 - 4. Locker Configuration: Five tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - a. Hooks: One single prong.
 - 6. Ventilation: By horizontal slots at the top and bottom of door.
 - 7. Locking: Padlock hasps, for padlocks provided by Owner.

2.03 SOLID PLASTIC LOCKERS

- A. Lockers: Factory assembled, made of solid plastic panels, homogenous color throughout.
 - 1. Material: Solid high density polyethylene (HDPE).
 - 2. Doors: Full overlay without frame.
 - 3. Where locker ends or sides are exposed, provide same finish as fronts or provide extra panels to match fronts.
 - 4. Door Color: To be selected by Architect.
 - 5. Body Color: Manufacturer's standard white or light color.
- B. Component Thicknesses:
 - 1. Doors: 1/2 inch minimum thickness.
 - 2. Locker Body: Tops, bottoms, backs, and shelves 3/8 inch minimum.
- C. Hinges: Full height of locker, manufacturer's standard heavy duty type.

- D. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/4 inch high of block font style, in contrasting color.
- E. Locker Base: Solid plastic base, 4 inches high, field assembled.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Install end panels, filler panels, and sloped tops.
- F. Install fittings if not factory installed.
- G. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10 5143 TURNOUT GEAR STORAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted Turnout Gear Storage with hooks and shelves.

1.02 RELATED REQUIREMENTS

- A. 06 10 53 - Wood Blocking and Curbing: In-wall framing and plates.

1.03 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide manufacturer's product data including installation instructions.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products in accordance with Section 01 60 00 - "Product Requirements".

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Basis of Design Manufacturer: GearGrid LLC, 670 SW 15th St., Forest Lake, MN 55025. .
www.greagrid.com; ph 888-643-6694.
- B. Other Acceptable Manufacturers:
 - 1. Cogan Wire and Metal Products, Ltd.; www.cogan.com
 - 2. Ready Rack; www.readyrack.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRODUCT

- A. Geargrid Wall Mount Lockers.
 - 1. Size: "Jumbo" - 24"W x 24"D x 74-1/2"H.
 - 2. Shelves and Hooks: Two (2) shelves constructed of high-strength 1/4" wire, and three (3) apparel hooks per locker.
 - 3. Adjustability: Wire shelves adjustable in 3" increments.
 - 4. Frame: Heavy-duty 1-1/4" tubing.
 - 5. Side and Back Grids: High-strength 1/4" wire.
 - 6. Name Plate: 20 gauge sheet metal, accepts 2" x 18" custom printed tag.
 - 7. Mounting Brackets: 11 gauge steel.
 - 8. Finish: Durable powder coat.
- B. Geargrid Free-Standing Units-Floor mounted
 - 1. Locker Sizes:
 - a. Jumbo 24" x 24" deep, 83" height
 - 2. Shelves and Hooks: Two (2) shelves (top and bottom) constructed of high-strength 1/4" wire, and three (3) apparel hooks per locker.
 - 3. Frame: Heavy-duty 1-1/4" tubing.
 - 4. Side and Back Grids: High-strength 1/4" wire.
 - 5. Mounting Brackets: 11 gauge steel.
 - 6. Finish: Durable powder coat.

2.03 ACCESSORIES

- A. Provide the following accessories for each individual locker:

1. Horizontal hang bar.
2. GearHange.
 - a. Coat Drying Hanger
3. Secure Door.
 - a. Top cover
4. Placard Channel: 20 gauge steel to accept a 2" x 12" name placard.

2.04 FINISH

- A. General: All system components excluding assembly and mounting hardware and stainless steel components are to receive the standard finish.
- B. B. Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable and UV-stable TGIC powder coating process. Thickness of applied finish shall be 3 – 4 mm for added protection.
- C. 1. Anti-Corrosive Primer: (Optional)
- D. C. Color: as selected from standard range (Manufacturer must provide a minimum 7 standard color choices for selection).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers secure, plumb, square and in line.
- C. Anchor lockers with appropriate anchor devices to suit materials encountered.

END OF SECTION 10 51 43

**SECTION 10 5500
POSTAL SPECIALTIES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Curbside mail box

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. 39 CFR 111 - U.S. Postal Service Standard 4C; Current Edition.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.

PART 2 PRODUCTS**2.01 CENTRAL MAIL DELIVERY BOXES**

- A. Manufacturers:
 - 1. Salsbury Industries: www.mailboxes.com/#sle.
 - 2. Mail Boss. Epoch Design LLC, www.mailboss.com, Ph 800.589.7990
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Curbside Pedestal Mounted Mailbox: Provide products approved for United States Postal Service (USPS) delivery.
 - 1. Basis of Design: Mailboxes.com, Salsbury 4300 Series Roadside Mailbox
 - 2. Model: 4325 locking
 - 3. Provide inground mounted post-4385

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that concrete base and anchor bolts are ready to receive pedestal-mounted units.
- B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.
- B. Adjust and lubricate door hardware to operate properly.

END OF SECTION

**SECTION 10 7500
FLAGPOLES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

- A. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.
- B. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.
 - 1. Provide stamped and signed shop drawing for deferred permit submittal.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Flagpoles:
 - 1. Bolander and Sons. www.bolanderflagpole.com; phone 800.434.0279
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001
 - 1. Bolander and Sons; Extra Heavy Ground Set Cone Tapered Aluminum
 - 2. Material: Aluminum.
 - 3. Design: Cone tapered.
 - 4. Mounting: Ground mounted type.
 - 5. Outside Butt Diameter: 5 inches.
 - 6. Nominal Wall Thickness: .156 inches.
 - 7. Nominal Height: 30 ft; measured from nominal ground elevation.
 - 8. Halyard: Interior type.
- B. Performance Requirements:
 - 1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 130 miles/hr wind speed, in accordance with NAAMM FP 1001.

2.03 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

2.04 ACCESSORIES

- A. Finial Ball: Stainless steel, 6 inch diameter.
- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. Halyard: 5/16 inch diameter polypropylene, braided, white.

2.05 OPERATORS

- A. Hand Crank: Removable locking cover cam type.

2.06 FINISHING

- A. Aluminum: Anodized to Class 1, Clear color.
- B. Finial: Gold anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.04 ADJUSTING

END OF SECTION

SECTION 11 3013 RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen appliances.
- B. Laundry appliances.
- C. Ice machine / bin.

1.02 RELATED REQUIREMENTS

- A. Section 26 0583 - Wiring Connections: Electrical connections for appliances.
- B. Section 16123 - Wires and Cables: Electrical connections for residential equipment.

1.03 SUBMITTALS

- A. See Section 01300 - "Submittals", for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.
- C. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

- A. Refrigerator: One (1) each, True T-49-HC Reach-In Solid Door Refrigerator
 - 1. Capacity: cu. ft;
 - 2. Energy Star Qualified
 - 3. Stainless steel finish
 - 4. Heavy duty PVC coated wire shelves
- B. Freezer: One (1) each, True T-49F-HC Reach-In Solid Door Freezer
 - 1. Capacity: cu. ft;
 - 2. Energy Star Qualified
 - 3. Stainless steel finish
 - 4. Heavy duty PVC coated wire shelves
- C. Range : Natural gas, free-standing sealed burners.
 - 1. Wolf Model GR304, Two (2) each.
 - 2. Color: Stainless Steel
 - 3. Size: 30 inches wide.
- D. Cooking Exhaust: Range hood.
 - 1. Wolf Model PW362418 Two (2) each, Color: Stainless steel
 - a. Size: 36 inches wide.
 - b. Fan: Variable- speed, 600 + cfm. Internal.
 - c. Lighting: Two 75 Watt Bulbs.

- d. Exhaust: 10" Round
- e. Filters: Dishwasher safe full coverage filters.
- f. Duct Covers: 36" Pro Wall Hood Duct Covers
- E. Microwave : Countertop, Two (2) each - Panasonic NN-SN67KS. stainless steel.
 - 1. Capacity: 1.2 cubic ft.
 - 2. Power: 1200 watts.
 - 3. Features: Include Recessed glass turntable., INVERTER Precision Cook Technology
- F. Dishwasher: Undercounter.
 - 1. Bosch Model 800 Series- Stainless Steel SHEM78Z55N
 - a. 6 Cycle selections with 5cycle options.
- G. Ice Maker: Undercounter.
 - 1. Scotsman CU50 - 50lb Cube Ice Machine. Self contained undercounter with storage.
 - 2. Model: CU50PA-1 (with pump).
- H. Coffee Maker:
 - 1. Bunn Axiom 15-3, 12 cup, three lower burners
 - 2. Capacity: 200 oz tank

2.02 LAUNDRY APPLIANCES

- A. Clothes Washer: Top-loading stationary.
 - 1. Size: Large capacity. 3.2 CU. ft.
 - 2. Controls: Solid state electronic.
 - 3. Cycles: Include 6 preset.
 - 4. Motor Speed: Variable speed, 1HP . 7 cycles
 - 5. Features: Include stainless steel drum.
 - 6. Finish: Painted steel , color as indicated.
 - 7. Manufacturers:
 - a. Speedqueen; Model TR5 Comercial grade
- B. Clothes Dryer: Natural gas, stationary.
 - 1. Size; Large capacity 7.0 cu. ft.
 - 2. Manufacture:
 - a. Speed Queen Model DC5 Comercial grade
 - b. Galvanized Cylinder.
 - c. Cycles: Include 4 preset.
 - d. Temp selections: 4

2.03 ICE MACHINE-COMMERCIAL

- A. Scotsman Model CME 506WS -1D with HTB350 Modular Bin.
 - 1. 500 lb Cube Ice Machine
 - 2. 536 lb bin capacity

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.04 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION 11450

NOT FOR BID

**SECTION 11 3100
COMMERCIAL EQUIPMENT****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Breathing Air Compressor
- B. Cylinders.
- C. Decon Washer

1.02 RELATED REQUIREMENTS

- A. Section 26 0000 - Equipment Wiring: Electrical connections for equipment.

1.03 REFERENCE STANDARDS

- A. AGA - American Gas Association.
- B. NEMA - National Electrical Manufacturers Association.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide manufacturer's data indicating dimensions, capacity and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Electrical Appliances: Listed and labeled by UL and complying with NEMA Standards.

PART 2 PRODUCTS**2.01 BREATHING AIR REPLENISHING SYSTEMS**

- A. UNICUS 4S-High Pressure Breathing Air Compressor
 - 1. Model UN 4S / 18H-E3
 - 2. Pressure: 6,000 PSIG (414 BAR)
 - 3. Purification system: P5 B-Securus
 - 4. Optional Accessories: Cylinders

2.02 DECON WASHER

- A. Solo Rescue - SCBA Decon Washer 26094 or 29275
 - 1. Heavy Duty Basket with holder for 2 single or double SCBA
 - 2. Two Gear Holders for boots, gloves and helmets
 - 3. Metering Dosing Pump
 - 4. ProBlend Detergent 2.5 gal

2.03 DRYER CABINET, COMMERCIAL, ELECTRIC.

- A. Smart-Dry 6 All-Purpose Drying Cabinet
- B. Manufacture: Ready Rack, www.readyrack.com, Ph-800.991.2120.
- C. Construction: Powder coated galvanized steel, interior lighting
- D. Features: Programable control that ends with "cool down", 6 detachable hangers, double overheat protection, adjustable prestart time.
- E. Electrical Connection:
- F. Options:

2.04 WASHER EXTRACTOR: MODEL 30022 VRJ RIGID-MOUNT WASHER EXTRACTOR, AS MANUFACTURED BY MILNOR; WWW.MILNOR.COM.

- A. Size: Large capacity. 60 lbs

- B. Controls: Solid state electronic, with electronic moisture-sensing dry control.
- C. Temperature Selections: One.
- D. Cycles: Include normal.
- E. Speeds: 7 speeds
- F. RinSave water saving technology.
- G. Features: Include sound insulation, end of cycle signal, and 200 G Extraction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are present and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust operating equipment for efficient and for smooth operation.

END OF SECTION

**SECTION 11 6623
GYMNASIUM EQUIPMENT****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Gymnasium exercise machines and equipment.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete floor slab to receive floor sleeves and anchors.
- B. Section 09 6566 - Resilient Athletic Flooring: Gymnasium flooring.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
 - 1. Manufacturer's installation instructions.
- C. Operating and maintenance data for each operating equipment item.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.
- B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.
- C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Gymnasium Equipment:
 - 1. Advanced Exercise
 - 2. Contact: Jarret Tooley; 310.409.3732; jtooley@advancedexercise.com
 - 3. Or approved equal.
 - 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 EXERCISE EQUIPMENT

- A. Exercise Machines, Equipment, Free weights, Racks, Accessories, etc.
 - 1. Contractor to purchase and install all exercise equipment and accessories shown in Appendix B.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.
- B. Verify that electrical services are correctly located and have proper characteristics.

3.02 INSTALLATION

- A. Install in accordance with Contract Documents and manufacturer's instructions.
- B. Install equipment rigid, straight, plumb, and level.
- C. Secure equipment with manufacturer's recommended anchoring devices.
- D. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

- A. Verify proper placement of equipment.
- B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.
- C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration; lubricate equipment as recommended by manufacturer.

3.04 CLEANING

- A. Remove masking or protective covering from finished surfaces.
- B. Clean equipment in accordance with manufacturer's recommendations.

3.05 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 12 2400
WINDOW SHADES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Interior manual roller shades.
- B. Interior motorized roller shades.
- C. Motor controls.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- B. Section 26 2726 - Wiring Devices: Finish requirements for wall controls specified in this section.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.
- C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
- D. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- C. Sequencing:

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
 - 1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, mounting dimension requirements for each product and condition, and operation direction.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum 5 years of documented experience with shading systems of similar size and type.
 - 1. Manufacturer's authorized representative.
 - 2. Factory training and demonstrated experience.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Shade Hardware: One year.
2. Electronic Control Equipment: One year.
3. Fabric: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Manually Operated Roller Shades:
 1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com
 - a. Contact email: kgreenway@draperinc.com.
 2. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
 3. TimberBlindMetroShade; SolarVue Manual Roller Shade: www.timberblinds.com/commercial-division/#sle.
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Interior Motorized Roller Shades, Motors and Motor Controls:
 1. Draper, Inc; Motorized FlexShade: www.draperinc.com
 - a. Contact email: kgreenway@draperinc.com.
 2. MechoShade Systems LLC; UrbanShade Single Roller - Motorized: www.mechoshade.com/#sle.
 3. TimberBlindMetroShade; SolarVue Motorized Roller Shade: www.timberblinds.com/commercial-division/#sle.
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MANUALLY OPERATED WINDOW SHADES

- A. Heavy-Duty Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation. Basis of Design: Clutch-Operated FlexShade NEXD as manufactured by Draper, Inc.
 1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
 - a. Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.
 - b. Bead chain loop: Stainless steel bead chain.
 - c. Bead Chain Hold Down: P-Clip.
 2. Dual Roller Configuration / Mounting:
 - a. Dual roller fascia. Endcaps with fascia designed for surface mounting of dual roller window shades.
 - 1) Endcaps: 1028 steel stamping.
 - 2) Fascia: L-shaped cover of extruded aluminum, .060 wall. Assembly snaps onto endcaps without exposed fasteners.
 - 3) Size: 4-3/4 inches deep x 7 inches high x length required by window opening.
 - 4) Finish: Clear anodized.
 - b. Shade slat:
 - 1) Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.
 - c. Aluminum Light Gap Reduction Channels
 - 1) U Channel - 1 inch by 2-1/2 inches (25 mm by 64 mm).with light filtering strip
 - 2) Side and sill U channel installation
 - 3) Shades to be outside mount
 3. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.
 - a. Minimum Roller Tube Diameter: 1.50 inches.

- b. Fabric Connection to Roller Tube: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
- c. Fabric Length: 6 inches (152 mm) greater than window height minimum.

2.03 MOTORIZED WINDOW SHADES

- A. Type: Motorized vertical roll-up, fabric, window shade with motors, controls, mounting brackets, and other components necessary for complete installation. Basis of Design: Motorized FlexShade as manufactured by Draper, Inc.
 - 1. Endcaps and fascia.
- B. Shade Motor and Control System
 - 1. Motorized FlexShade RTS AC. Basis of Design.
 - a. Standard Motor: 120V AC motor with built-in radio receiver. Tubular motor concealed inside each shade roller tube.
 - b. Individual Control, Group Control and Individual and Group Control:
 - 1) Four channel wireless wall switch for radio motor control-White.
- C. Configuration:
 - 1. Single Roller.
 - a. Mounting: Wall Mounted / no fascia
 - 1) Shade slat:
 - (a) Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.
- D. Roller: Fabricated from extruded aluminum or steel. Wall thickness and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

2.04 SHADE FABRIC

- A. Light Filtering Fabrics:
 - 1. SheerWeave Series SW2400 by Phifer: VOC Emissions: GREENGUARD Gold - certified as a low emitting fabric. Manufacturer to supply GREENGUARD Gold. 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave. Fire rating: NFPA 701. Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. Series SW2400, 3 percent open, .019 inches thick.
- B. Room Darkening Fabrics
 - 1. SheerWeave Series SW7500 by Phifer: PVC-free polyester with an acrylic coating. Fire rating: California U.S. Title 19 (small scale), NFPA 101 (Class A Rating), NFPA 701 TM#1 (small scale), BS 5867 Part 2 Type B Performance, CAN/ULC-S 109 (large and small scale), IBC Section 803.1.1 (Class A Rating), CAN/CGSB 2-4.162-M80. Bacterial and fungal resistance: ASTM E 2180 and ASTM G21. GREENGUARD Gold

2.05 MOTOR CONTROLS

- A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- B. Provide all components and connections necessary to interface with other systems as indicated.
- C. Manual Controls:
 - 1. Control Functions:
 - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.

- b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.03 SYSTEM STARTUP

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.
- C. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
- D. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.06 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.07 SCHEDULES

- A. Manually Operated Shades:
 - 1. Shade Type SM-1 Single Roller
 - a. Mounting Type: Wall Mounted.
 - b. Location: Kitchen-Type B window, Office- Type A window, Lobby/Watch-Type D storefront.
 - 2. Shade Type SM-2 Dual Roller
 - a. Mounting Type: Wall mounted
 - b. Location: Sleep Quarters-Type A window
- B. Motorized Shades:
 - 1. Shade Type MS-1 Single Roller
 - a. Configuration/Mounting: Wall mounted
 - b. Location: Dayroom clerestory Type D windows

END OF SECTION

**SECTION 12 3600
COUNTERTOPS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 06 4100 - Custom Cabinets.
- B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

- A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. AWI (QCP) - Quality Certification Program; Current Edition.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- E. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- F. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- H. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- I. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.
- B. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

C. Fabricator and Installer Qualifications: Minimum 3 years experience in work of this Section.

1.06 WARRANTY

- A. Provide manufacturer's 10 year warranty against defects in material and workmanship.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: See Section 12 3100.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers:
 - 1) Formica Corporation; -: www.formica.com.
 - 2) Panolam Industries International, Inc Nevamar; -: www.nevamar.com.
 - 3) Wilsonart; -: www.wilsonart.com.
 - 4) Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
 - b. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - c. Finish: Matte or suede, gloss rating of 5 to 20.
 - d. Surface Color and Pattern: As selected by Architect from the manufacturer's standard line.
 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
 3. Back and End Splashes: Same material, same construction.
- C. Stainless Steel Countertops: ASTM A666, Type 304, stainless steel sheet; 16 gage, 0.0625 inch nominal sheet thickness.
1. Finish: 4B satin brushed finish.
 2. Exposed Edge Shape: Straight turndown with return; 1-1/2 inch high face, 1/2 inch return to face of case ; reinforced with hardwood or steel.
 3. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
 4. Splash Dimensions: 4 inch high by 1 inch thick, unless otherwise indicated.
- D. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
1. Flat Sheet Thickness: 3/4 inch, minimum.
 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Corian Quartz by Dupont - Basis of Design.
 - (a) www.corianquartz.com;
 - 2) Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

- b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
- c. Finish on Exposed Surfaces: Polished.
- d. Color and Pattern: As selected by Architect from manufacturer's standard line.
- 3. Other Components Thickness: 3/4 inch, minimum.
- 4. Back and End Splashes: Same sheet material, demi- or half-bullnose top; minimum 4 inches high.
- 5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 FABRICATION

- A. Cut quartz panels accurately to required shapes and dimensions.
- B. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- C. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches, unless otherwise indicated.
- D. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
 - 1. Weld joints; grind smooth and polish to match.
 - 2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
 - 3. Provide wall clips for support of back/end splash turndowns.
 - 4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install fabrications in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- D. Attach stainless steel countertops using stainless steel fasteners and clips.
- E. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces in accordance with manufacturer's instructions.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 12 5800
RESIDENTIAL FURNITURE****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Reclining Chairs.
- B. Dining Table and Chairs
- C. Office Desks and files
- D. Mattresses
- E. Outdoor Dining Table and Chairs

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- B. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to project site in wrapped in protective materials..
- B. Store under cover and elevated above grade.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer Warranty: Provide 1 year min. manufacturer warranty for defective finishes or moving parts. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS**2.01 MATTRESSES**

- A. Basis of Design Manufacturer: Tempur-Pedic.
- B. Seller: . Tempur-Pedic, North America, LLC;
 - 1. Contact: Tempur-Sealy Wholesale Customer Service, 888.298.4123.
- C. Description: Tempur-Pedic Adapt 2.0, Medium Mattress
 - 1. Composition: Memory Foam layers.
 - a. Cool To touch Cover
 - b. Foam; Comfort layer 4cc, Support layer 4cc.
 - 2. Size: 11 inch., Twin XL
 - 3. Warranty: 10 years covering manufacturing defects.
 - 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 RECLINER

- A. Basis of Design Manufacturer: Lazy Boy Furniture.
 - 1. Model: Randell Rocking Recliner, designed for tall users.
- B. Description: Upholstered Reclining Seating
 - 1. Size: 45.5W x 41.5D x 46.5H.
 - 2. Construction: Heavy guage steel frame, hardwoods used in seat contruction.
 - 3. Upolstery: 100% polyester fabric, stain resistant
 - 4. Color: To be selected by Architect from full range.
 - 5. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.03 DINING TABLE

- A. Seller: G/M Business Interiors; www.gmbi.net; ph 800.686.
- B. Description: Conference tTable Base and Top
 - 1. Base: UNIVERSAL, Size: 60DX144W TOP, PANEL BASE KIT, LAMINATE
 - a. P1 -BASE PROFILE- BASIC
 - b. SK LAMINATE COLOR-SKYLINE
 - 2. Top: EPIC, 60DX144W, CONFERENCE TOP, RECTANGLE, LAMINATE
 - a. VSK RIM PROFILE SOFTENED PVC,SKYLINE
 - b. STD TOP LAMINATE - Standard Laminate
 - c. SK LAMINATE COLOR - SKYLINE
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.04 DESKS AND LATERAL FILES

- A. National Business Furniture; www:NBF.com, Ph-800-558-1010.
- B. Desks
 - 1. Mfg: NBF Signature Series, At Work Collection, L-Shaped Desk 71"w, Item #225610
 - 2. Assembly required.
 - 3. Laminate construction, color: as selected from standard choices.
 - 4. Two utility drawers, three hanging file drawers (lockable)
 - 5. Fully reversible return, one grommet hole in return
 - 6. Dims: 70.87"W x 82.67"D x 28.94"H
 - 7. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. Two drawer Lateral File
 - 1. Mfg: NBF Signature Series, At Work Collection, Item #30626
 - 2. Laminate construction, color: as selected from standard choices.
 - 3. Fully assembled.
 - 4. 2 full extension file drawers accommodate both letter and legal sized documents. Locking drawers.
 - 5. 275lb capacity
 - 6. Meets ANSI / BIFMA safety standards.
 - 7. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.05 CHAIRS

- A. Seller: GM Business Interiors, PH 800.686.6583; 1099 W. La Cadena Drive, Riverside, CA.
- B. Office and Dinning Chairs; Standard height, adjustable arms, casters
 - 1. Herman Miller WK Chairs, model Embody
 - a. Base finish: graphite,
 - b. Frame finish: graphite
 - c. Fabric: rhythm-PR Cat 2, 30-colors-rhythm black.
 - d. Casters: 2 1/5" hard caster, black yoke, carpet only.
 - e. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- C. Sleep Quarters Task Chairs
 - 1. Herman Miller Casper Stacking Chair.
 - 2. Color: Graphite
 - 3. Frame: Metallic Silver
 - 4. Caster: Hard Floor or arpet Casters
 - 5. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.06 PATIO DINING TABLE AND CHAIRS

- A. Manufacturer: Hanover
- B. Description: Cast Aluminum table and Aluminum / sling fabric chairs
 - 1. Style: Fontana 7 piece.

2. Size: Table 84L x 42W .
3. Construction: Ca Aluminum
4. Chairs: Sling PVC Fabric , Weight Cap. 250 lbs
5. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.07 WIRE SHELVES

- A. Chrome finish, adjustable shelves. Basis of Design Regency NSF Chrome 4-Shelf Kit
- B. Unit Size: 18" x 48" x 54"H (600lb rated) and 14" x 36" x 54"H (600 lb rated)
- C. Shelves: (4) each unit, 600lb capacity rated

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that furniture is clean and not damaged..

3.02 ADJUSTING

- A. Level tables.

**SECTION 13 3419
METAL BUILDING SYSTEMS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. Metal Roof Panels, gutters and down spouts.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast In Place Concrete

1.03 REFERENCE STANDARDS

- A. AISC 360 - Specification for Structural Steel Buildings; 2016.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2018.
- E. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2014.
- F. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).
- G. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings; 2016.
- H. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2017.
- I. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2018.
- J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2018.
- K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- M. MBMA (MBSM) - Metal Building Systems Manual; 2012.
- N. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- O. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on profiles, component dimensions, fasteners.
- C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from

datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

1. Provide Structural calculations

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
 1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
 - 2.
 3. Comply with applicable code for submission of design calculations as required for acquiring permits.
- B. Perform work in accordance with AISC 360 and MBMA (MBSM).
- C. Perform welding in accordance with AWS D1.1/D1.1M.
- D. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
 1. Not less than 5 years of documented experience
- E. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.07 WARRANTY

- A. See Section 01 7700 - Closeout Submittals, for additional warranty requirements
- B. All Components: Manufacturer's standard one (1) year workmanship warranty.
- C. Roof Panels: Manufacturer's standard twenty-five (25) year paint color-finish Warranty and manufacturer's standard twenty (20) year Zinalume no Perforation warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Buildings Systems:
 1. CBC Steel Buildings, a Nucor Company: www.cbcsteelbuildings.com.
 2. American Buildings Co, a Nucor Company: www.americanbuildings.com
 3. Nucor Building Systems; -: www.nucorbuildingsystems.com.
 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 ASSEMBLIES

- A. Single span rigid frame, with Lean-to.
- B. Bay Spacing: 25 ft / 16'-4"; verify with plans.
- C. Primary Framing: Rigid frame of rafter beams and columns, intermediate columns, and wind bracing.
- D. Secondary Framing: Purlins, and other items detailed.
- E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, and accessory components.
- F. Roof Slope: 1/2 inches in 12 inches.

2.03 PERFORMANCE REQUIREMENTS

- A. Design structural members to withstand 20 psf live load, and 115 psf positive and negative wind loads.
 1. Verify required location criteria with "County of San Bernardino Building and Safety Dept. Design Load Criteria."
- B. Design structural members to withstand Class 30 wind uplift in accordance with UL 580.

- C. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
- D. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of ____ degrees F.

2.04 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A36/A36M.
- B. Anchor Bolts: ASTM F1554, Grade 36, Class 1A, with no preference for protective coating.
- C. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.
- D. Welding Materials: Type required for materials being welded.
- E. Primer: SSPC-Paint 20 zinc rich.
- F. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 - 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.05 MATERIALS-STRUCTURAL STEEL

- A. Materials:
 - 1. Structural Plate or Bar Stock: Minimum yield strength (Fy) of 55,000.
 - 2. Cold Formed Structural Steel: Minimum yield strength (Fy) of 55,000.
 - 3. Primary Framing Structural Bolts and Nuts: ASTM A325; size and quantity required by metal building system manufacturer.
 - 4. Prime Coat Paint: Manufacturer's standard equal to Fed. Spec. TT-P-636D.
- B. Fabrication:
 - 1. Primary Framing: Rigid Frames of shop-welded steel plate columns and rafters, as per drawings and uniform depth sections as required by drawings. Complete with all necessary stiffeners, connection plates, and holes for field bolted assembly.
 - 2. Columns end Rafters: Fabricated with holes in web and/or flanges for attachment of secondary members.
 - 3. Splice Plates: Factory fabricate for precision for all rafter-to-rafter and/or column-to rafter connections, complete with connection boltholes.
 - 4. Base Plates, Cap Plates, Splice Plates, and Stiffeners: Fabricate to sizes required. Complete with all holes for connection of primary and secondary structural members. Factory weld into place.
 - 5. Join flanges and webs of structural members fabricated of plate or bar stock together by continuous submerged automatic arc welding process with all welding performed under the supervision of certified welders in accordance with standard practices of AWS D1.1.
 - 6. All shop welding is to be continuously inspected by a designated qualified inspection agency unless the fabricator is approved by the International Conference of Building Officials Evaluation Service, (ICBO-ES).
 - 7. Make all primary rigid frame field-bolted connections with A325 high-strength bolts of size required by building system manufacturer.
 - 8. Clean all components of oil, dirt, loose scale and foreign matters. Factory paint with Manufacturer's standard primer coat(s).
- C. Secondary Framing, (Purlins, Girts, Struts, Flange Bracing, Base Angles, as required).
 - 1. Purlins: Manufacturer's standard 8" & 9½" Z sections roll formed from minimum yield (Fy) 55,000 steel, punched for attachment.
 - 2. Girts: 8" & 9½" Z or channel sections of roll formed minimum yield (Fy) 55,000 steel, punched for attachment with ½" diameter bolts.
 - 3. Eave Struts: 8" & 9½" deep sections of cold-formed minimum yield (Fy) 55,000 steel, with vertical web to receive sidewall panels and two (2) ½" diameter bolt attachments to rigid frame in factory-punched holes in column or bracket.

4. Flange Braces: Steel angles attached to purlin or girt, to support rigid frame flanges as required. Indicated by design and noted on final shop drawings.
5. Clean secondary framing components to be free from oil, dirt, loose scale, and foreign matter and coated with a G-90 galvanized covering.

2.06 MATERIALS-ROOF

- A. Roof Panels: Precision roll-formed to provide a 36" wide net coverage from 24 ga. steel, and shall have four major corrugations at 12" centers with two minor corrugations located symmetrically between two major corrugations. Panels shall have a support bearing leg on one lap corrugation, which shall support the panel at the side laps. Provide manufacturer's maximum-length panels to minimize number of end laps. For longer runs, panels shall be end lapped a minimum of 6" over a support member. All side laps and end laps shall have a 1" wide sealing compound pieced in such a manner as to prevent entry of water, dust, and air into the building
- B. Panel Finishes: manufacturer's standard R panel with 24 ga. 80,000-psi steel. Exterior finish is pre-painted AZ50 aluminum-zinc alloy coated. Pre-painted panels shall have Premier Pacific Kynar 500 finish in colors as Specified on drawings. Warranty of 20-year material and 35-year paint finish applies
- C. Roof perimeter trim: gutter and rake fascia shall be 22 ga. in manufacturer's standard colors as selected by Owner

2.07 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.
- B. Provide framing for skylight openings.

2.08 FABRICATION - GUTTERS AND DOWNSPOUTS

- A. Form gutters and downspouts of 4" profile and size indicated to collect and remove water. Fabricate with connection pieces.
- B. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
- C. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.09 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.
- B. Exterior Surfaces of Roof Components and Accessories: Precoated enamel on steel of modified silicone finish, standard color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

- A. Erect framing in accordance with AISC 360.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without approval.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - ROOF PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Use concealed fasteners.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Slope gutters minimum 1/8 inch/ft.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
- B. Roofing: 1/8 inch from true position.

END OF SECTION

SECTION 22 0000
GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. The General conditions, supplementary conditions, special Requirements, and applicable portions of Division 1 of the specification are a part of this Division and the requirements contained herein are supplementary to them.
- B. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 ABBREVIATIONS AND DEFINITIONS (as used on Division 22 Drawings and herein)

- A. This Division is abbreviated and includes incomplete sentences. Supply omitted words by inference.
- B. Symbols: "S" means submittals are required; "M/O" means Maintenance/Operating data is required; see paragraphs hereinafter.
- C. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- D. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- E. "Ductwork" means ducts, plenums, compartments, casings or any like devices, including the building structure, which are used to convey or contain air.
- F. "Extend", "Submit", "Repair", "Abandon", "Replace", "Remove" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- G. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constructed authorities and public utility franchise holders having jurisdiction.
- H. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- I. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces which are not included in the utility areas definition.
- J. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- K. "Below Grade" means buried in the ground.
- L. "Substantial Mechanical Completion" means all components of all systems are functioning but lacking in final adjustment.
- M. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid which the device will serve.

1.03 DESCRIPTION

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.04 RELATED WORK

- A. Coordination: Refer to Architectural, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of mechanical work in relation to the work of other Divisions.

- B. Examine other Divisions for work related to the work of this Division especially Division 26 - ELECTRICAL.

1.05 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or the specifications, request clarification.
- B. The Architect shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflict not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

1.06 PERMITS AND INSPECTIONS

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.07 CODES AND REGULATIONS

- A. By submitting a bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract documents and the Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specify references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted)
 - 1. All local codes; city and/or County as applicable
 - 2. OSHA requirements
 - 3. Uniform Building Code
 - 4. Uniform Mechanical Code
 - 5. Uniform Plumbing Code
 - 6. California Code of Regulations (CCR) Titles
 - 7. Fire Marshal Regulations
 - 8. Regulations of all other authorities having jurisdiction.
- C. Where conflict or variation exists among codes, the most stringent shall govern.
- D. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- E. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of

materials and equipment, submit certified copies of test reports specified in the individual sections.

- F. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- G. Permits and Certificates of Inspection: Furnish the originals.
- H. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- I. Other data required by other sections of this Division. Furnish 2 copies.

1.08 RECORD AND DOCUMENTATION

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work:

- 1. Record (As-Built) Drawings:

- a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
- b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
- c. Furnish the originals.

- 2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated mechanical systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent, shall be provided to the Architect in accordance with the Division 1 section on Maintenance and Operation Manuals. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL

PROJECT TITLE.....

CONTRACTOR.....

Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:

- a. Updated approved materials list, shop drawings and catalog information of all items indicated by symbol "M/O" at titles or beginning of paragraphs.
- b. System layout showing piping, valves and controls.
- c. Wiring and control diagrams with data to explain detailed operation and control of each component.
- d. A control sequence describing start-up, operation and shutdown.
- e. Detailed description of the function of each principal component of the system.
- f. Procedure for starting.
- g. Procedure for operation.
- h. Shut-down instruction.
- i. Installation instructions.
- j. Adjustments, maintenance and overhaul instructions.
- k. Lubrication schedule including type, grade, temperature range and frequency.

- l. Safety precautions, diagrams and illustrations.
 - m. Test procedures.
 - n. Performance data.
 - o. Parts lists, with manufacturer's names and catalog numbers.
 - p. Preventive maintenance schedule.
 - q. Service organization with name, address and telephone number.
 - r. Valve identification chart and schedule.
 - s. ASME certification
 - t. Air Balance report.
- B. Standard Compliance: Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards (ANSI), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Underwriters Laboratories (UL), American Refrigeration Institute (ARI), American Gas Association (AGA), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

1.09 TOOLS

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.10 CONSTRUCTION COST BREAKDOWN

- A. To assist the Architect and Engineer in evaluation of the construction cost, the Contractor shall prepare and submit for review a construction cost breakdown for the major subdivisions of the mechanical work.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Cost breakdowns shall be submitted and approved prior to the first payment request. Send one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- B. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted as a substitution by the Architect. Where three or more manufacturers are listed as "acceptable manufacturers" however, then the products furnished shall be the product of one of the manufacturers listed. Manufacturers listed as "acceptable manufacturers" shall meet quality and performance of a particular one specified by both name and catalog number.

2.02 SUBSTITUTIONS

- A. General: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the Architect's request. If in the Architect's opinion the products as presented in this first submittal are in variance with the specified products, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified products shall be furnished. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any changes (whether architectural, structural, electrical or mechanical) necessary to accommodate the substitution.
- B. Specific: Refer to other sections of this Division for additional requirements.

2.03 SUBMITTALS

- A. General:
 - 1. Provide for all items indicated with the symbol "S" at titles or beginning of paragraphs in accordance with the Division 1 section covering submittals and as herein specified. Where warranty of longer than one year is specified, include such warranty with submittal. Architect's review of the submittal is only for general conformance with design compliance with the information given in the contract documents. The submittal procedure is required as an effort to minimize the problems which occur due to the discovery of Contractor non-compliance at the construction site. The Contractor is responsible for conformation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all Divisions of the work. Deviations, if any, from Contract documents shall be clearly and completely indicated (by a separate letter if deviations are extensive) in the submittals, and the lack of such is deemed complete compliance with Contract Documents without any deviations. Submittals favorably processed will not relieve the Contractor of responsibility for deviations not so reported nor for errors in the submittal.
 - 2. In addition to the above, upon permission to proceed after review of submittal and prior to the installation of work, submit dimensioned and scaled drawings (not less than 1/4-inch equal to one foot) of all mechanical equipment rooms and areas. Such layouts shall indicate, but not be limited to, all mechanical equipment, control panels, piping, housekeeping pads, ductwork, tube pull, access and maintenance clearances, and other like items. The layout shall also indicate major equipment to be provided under other Sections of work.

3. Contractor Stamp: All submittals shall be stamped with the following text and signed by the Contractors representative:

"IT IS HEREBY CERTIFIED THAT THE PRODUCTS SHOWN AND MARKED IN THIS SUBMITTAL ARE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND CAN BE INSTALLED IN THE ALLOCATED SPACES EXCEPT WHERE NOTED AS DEVIATIONS.

CERTIFIED BY:----- DATE:-----

4. All submittals shall be complete and with catalog data and information properly marked to show, among other things, equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities of performance as specified or indicated. Arrange the submittals in the same sequence as these specifications, and reference (at the upper right-hand corner) the particular specification provision for which each submittal is intended. Incomplete submittals will be rejected.
 5. For all work under Division 23, the notations by the Contractor or Supplier on submittal documents "Per Plans and Specifications", or "As Specified", or similar wording or phrasing is not acceptable and will be cause of rejection. Complete descriptive submittals are required for all Division 23 work.
 6. Refer to the other sections of this Division for specific requirements.
- B. Material List: Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.
 - C. Shop Drawings: Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the Owner's representative.
 - D. Other Submittals: As required by other sections of this Division.

PART 3 EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in the best standard practice of the trade.
- B. Execute the work so as to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned, and firmly secured in place.
- C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TESTS

- A. General:
 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings,

and shop fabricated ductwork.

- D. Keep cabinets and other openings closed to prevent entry of foreign matter.

3.04 CLEANUP AND HOUSEKEEPING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Leave exposed parts of the mechanical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

3.05 PROJECT CONDITIONS

- A. Site Examinations and Conditions:
 - 1. Regard information relative to existing conditions, services and structure as approximate only. Verify dimensions and locations, and be knowledgeable of all working conditions before submitting Bid. Verify pressure, location, size, and elevation of existing services (to which points of connection are to be made or crossed) as soon as possible and prior to commencement of any new work.
 - 2. Make minor deviations necessary to conform to actual locations and conditions. Submission of Bid presumes proper examination of Site, locations, dimensions and conditions, and no additional cost will be honored for lack of such examinations.
- B. Existing Services: Examine the Contract Drawings and visit the project site to ascertain the extent of the existing services. Where existing equipment/services serving existing structures and/or existing structures to be demolished are to remain in service, reroute, relocate, or extend such existing equipment and/or services to accommodate this project without additional cost.
- C. Interruption of Existing Services: Where it is necessary to reroute existing services or utilities, or to make connections of new work to existing services or utilities, give timely written notice of such intent to the Owner and secure written approval before proceeding. Make all such interruptions at such time as permitted by the Owner. Anticipate such interruptions to be made outside of normal working hours or normal working days; therefore, no additional cost will be permitted for such work. Except in a case of emergency involving life, limb or health, do not operate any existing equipment (including valves). Where such operations are necessary, they shall be performed by the Owner's personnel.
- D. Access and Placement of Work:
 - 1. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and re-assembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
 - 2. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Mechanical Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.
- E. Verification and Coordination: Drawings indicating suggested distribution routes are diagrammatic only, and all scaled and figured dimensions are approximate and are indicated for estimating purposes only. The Drawings do not indicate necessary offsets and like items. Do not construe Contract Drawings as fabrication drawings. Prior to fabrication and installation of work, verify all dimensions, sizes and distribution routes with actual conditions, and prepare submittal and fabrication drawings. Coordinate to avoid possible conflicts and resolve same where such exist. Install work to conform to structure, avoid obstruction, preserve headroom, and keep openings and passageway clear. Changes necessary, resulting from such verification and coordination, shall not be a cause for additional cost.

- F. See Drawings for extent of demolition.

3.06 WARRANTY

- A. Guarantee, in writing, all work against fault of any product or workmanship for a period of not less than one year after formal acceptance by the Owner; except, where longer periods are specified in the Specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components that are inactive because of said failure shall be suspended. The warranty period for such component shall resume running for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- B. Neither payments for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence of omission of Contractor in doing the work.

3.07 SAFETY REQUIREMENTS

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts in accordance with the OSHA 1910.219. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

3.08 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish printed copies of these recommendations to the installing Contractor and Architect prior to installation. Do not proceed with the installation of the item until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

END OF SECTION

SECTION 22 0500
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Piping materials and fittings.
2. Joining materials.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Piping Specialties
6. Grouting
7. Piping Insulation.
8. Equipment Installation.
9. Concrete Bases.
10. Erection of Metal Supports.
11. Erection of Wood Supports
12. Cutting and Patching

B. Related Sections:

1. Section 01 81 13 - Sustainable Design Requirements
2. Section 01 31 00 - Project Management and Coordination
3. Section 01 73 29 - Cutting and Patching
4. Section 01 78 43 - Spare Parts and Materials
5. Section 01 79 00 - Training
6. Section 01 78 23 - Operating and Maintenance Data
7. Section 03 30 00 - Cast-in-Place Concrete
8. Section 06 10 00 - Rough Carpentry
9. Section 07 62 00 - Sheet Metal Flashing and Trim
10. Section 07 84 00 - Firestopping
11. Section 08 31 00 - Access Doors
12. Section 09 90 00 - Painting
13. Section 22 05 53 – Identification for Plumbing Piping and Equipment: Labeling and identifying plumbing systems and equipment.
14. Section 31 20 00 – Earth Moving

1.02 REFERENCES

A. The American Society of Mechanical Engineers (ASME) Publications:

1. B1.20.1 "Pipe Threads, General Purpose, Inch"
2. B16.21 "Nonmetallic Flat Gaskets for Pipes Flanges"
3. B18.2.1 "Square and Hex Bolts and Screws, Inch Series"

B. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)

1. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
2. A536 "Standard Specification for Ductile Iron Castings"

3. B32 "Standard Specification for Solder Metal"
4. C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)"
5. D2235 "Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings"
6. D2657 "Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings"
7. D2672 "Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement"
8. D2846 "Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems"
9. D2855 "Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings"
10. D3138 "Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components"
11. F402 "Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings"
12. F477 "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe"
13. F493 "Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings"
14. F656 "Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings"
- C. American Welding Society (AWS) Publications:
 1. BRH "Brazing Handbook"
 2. A5.8 "Specification for Filler Metals For Brazing And Braze Welding"
 3. D1.1 "Structural Welding Code - Steel"
 4. D10.12 "Guide for Welding Mild Steel Pipe"
- D. American Water Works Association (AWWA) Publications:
 1. C110/ANSI A21.10 "Standard for Ductile-Iron and Gray-Iron Fittings, 3 In.-48 In. (76 mm-1,219 mm), for Water "
 2. C111/ANSI A21.11 "Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings"
- E. Copper Development Association (CDA) Publications:
 1. "Copper Tube Handbook"

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. 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.
- F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
 1. Product Data: For dielectric fittings, flexible connectors, plumbing sleeve seals, and identification materials and devices.
 2. Coordination Drawings: Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
 - a. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - b. Clearances for installing and maintaining insulation.
 - c. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - d. Equipment and accessory service connections and support details.
 - e. Exterior wall and foundation penetrations.
 - f. Fire-rated wall and floor penetrations.
 - g. Sizes and location of required concrete pads and bases.
 - h. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - i. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

1.05 QUALITY ASSURANCE

- A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting plumbing and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases.
 1. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design requirements. See drawings for equipment schedules and requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

- A. Coordinate plumbing equipment installation with other building components.

- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if plumbing items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Section 08 31 13 - "Access Doors and Frames."
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.08 POSTED OPERATING INSTRUCTIONS

- A. Provide and post operating instructions for all plumbing systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Approved Manufacturers:
 - 1. Dielectric Unions:
 - a. Hart Industries, International, Inc.
 - b. Watts Water Technologies, Inc.
 - c. Zurn Plumbing Products Group of Jacuzzi Brands, Inc
 - 2. Dielectric Flanges:
 - a. Capitol Manufacturing Company, A member of The Phoenix Forge Group
 - b. Central Plastics Co.
 - c. Watts Water Technologies, Inc.
 - 3. Dielectric-Flange Insulating Kits:
 - a. Central Plastics Co.
 - 4. Dielectric Couplings:
 - a. Lochinvar Corp.
 - 5. Dielectric Nipples:
 - a. Grinnell Mechanical Products, A Tyco International
 - b. Perfection Corporation
 - c. Victaulic Co. of America
 - 6. Plumbing Sleeve Seals:
 - a. Metraflex Inc.
 - b. PSI-Thunderline/Link-Seal

2.02 PIPE AND PIPE FITTINGS

- A. Refer to individual Divisions 22 piping Sections for pipe and fitting materials and joining methods.
 - 1. Section 22 11 16 - Domestic Water Piping.

2. Section 22 13 16 – Sanitary Waste and Vent Piping.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated, and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B32.
1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
- F. Brazing Filler Metals: AWS A5.8.
1. BCuP Series: Copper-phosphorus alloys.
 2. BAg1: Silver alloy.
 3. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- H. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
1. Sleeve: ASTM A126, Class B, gray iron.
 2. Followers: ASTM A47 malleable iron or ASTM A536 ductile iron.
 3. Gaskets: Rubber.
 4. Bolts and Nuts: AWWA C111.
 5. Finish: Enamel paint.

2.04 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.
- D. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

2.05 PLUMBING SLEEVES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 2. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, 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.

2.06 PLUMBING SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.07 PIPING SPECIALTIES

- A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 2. OD: Completely cover opening.
 3. Cast Brass: Split casting, with concealed hinge and set screw.
 - a. Finish: Polished chrome-plate.
 4. Cast-Iron Floor Plate: One-piece casting.
- B. Grout:
 1. Non-shrink, Nonmetallic Grout: ASTM C1107, Grade B.
 - a. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psig, 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specifies otherwise. Individual Division 22 piping Sections specifies unique piping installation requirements.
- B. General Locations and Arrangements: 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 as required by Division 01 Sections and as outlined in Part 1 of this section.
- C. Install piping at indicated slope.
- D. Install components with pressure rating equal to or greater than system operating pressure.

- E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends.
- G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - 1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
 - 2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
 - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - 4. Insulated Piping: Cast brass with concealed hinge, set screws, and chrome-plated finish.
 - 5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
- N. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of plumbing equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping rings where required.
 - 2. Build sleeves into walls and slabs as work progresses.
 - 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
 - b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
 - 4. 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 above finished floor level. Refer to Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing.
 - a. Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.
 - 5. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealant. Refer to Section 07 92 00 "Joint Sealants" for materials.
 - 6. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- O. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and plumbing sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing plumbing sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.

3. Assemble and install plumbing sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using plumbing sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing plumbing sleeve seals.
 1. Assemble and install plumbing sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stopping materials. Refer to Section 07 84 00 - "Firestopping" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to CDA's "Copper Tube Handbook."
 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 5. 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. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. 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.
 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- U. Piping Connections: Make connections according to the following, unless otherwise indicated:
 1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
 2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights is not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Owner's Representative.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. 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.
- E. Install equipment giving right of way to piping installed at required slope as specified in other Division 22 sections.
- F. Clearance from Electrical Equipment: Piping is prohibited in electric rooms and closets, elevator machine rooms and installation over transformers, switchboards and motor control centers.

3.03 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Section 03 30 00 - "Cast-in-Place Concrete."

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."
- C. Prime and paint all metal supports per Section 09 90 00 requirements.

3.05 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor plumbing materials and equipment.
- B. 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.
- C. Attach to substrates as required to support applied loads.

3.06 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for plumbing installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.
- C. Refer to Division 01 Sections for additional requirements.

3.07 GROUTING

- A. Install nonmetallic, non-shrink, grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.

- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

NOT FOR BID

SECTION 22 0517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION**3.01 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.

- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
- 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
 - 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.

END OF SECTION

SECTION 22 0518
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

NOT FOR BID

SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Bronze swing check valves.
 - 4. Bronze gate valves.
 - 5. Iron gate valves.
 - 6. Bronze globe valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.02 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.
- E. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.02 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.04 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.

- d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.05 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron or bronze.
- B. Class 125, RS Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

- a. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron or bronze.

2.06 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Red-White Valve Corporation.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron or bronze.
- B. Class 125, Bronze Globe Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.

- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron or bronze.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or gate valves.
 - 2. Throttling Service: Globe or ball valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze Angle Valves: Class 125, bronze disc.
 - 3. Ball Valves: Two piece, full port, brass brass trim.
 - 4. Bronze Swing Check Valves: Class 125, bronze disc.
 - 5. Bronze Gate Valves: Class 125, NRS.
 - 6. Bronze Globe Valves: Class 125, bronze disc.

END OF SECTION

SECTION 22 0529**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS**2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 5. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 6. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 7. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 8. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 0553**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.

1.02 SUBMITTAL

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.040-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Base color coding and size of letters and arrows shall conform to ANSI A 13.1, "Scheme for the Identification of Piping Systems."

END OF SECTION

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic hot-water piping.
 - 2. Domestic recirculating hot-water piping.
 - 3. Condensate drain piping.
 - 4. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
 - 1. Division 22 Section "Plumbing Equipment Insulation."

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
- C. Field quality-control reports.

1.03 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS**2.01 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: 60 percent by volume and 66 percent by weight.
 - 5. Color: White.

2.04 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.06 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Sheet and roll stock ready for shop or field sizing.
 - 3. Finish and thickness are indicated in field-applied jacket schedules.
 - 4. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - 5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pittsburgh Corning Corporation; Pittwrap.
 - b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.07 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex.
 - b. McGuire Manufacturing.
 - c. Truebro; a brand of IPS Corporation.
 - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures,
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Truebro; a brand of IPS Corporation.
 - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.

- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable

- insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- E. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.07 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:
 - 1. Flexible Elastomeric: 3/4 inch thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
 - 1. Flexible Elastomeric: 1/2 inch thick.
- C. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, 1-1/2 inches thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
 - 2. PVC: 20 mils thick.
 - 3. Aluminum, Corrugated: 0.016 inch thick.
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.
 - 2. Painted Aluminum, Corrugated: 0.016 inch thick.

3.12 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 1116
DOMESTIC WATER PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Specialty valves.
 - 3. Flexible connectors.
 - 4. Water meters furnished by utility company for installation by Contractor.
- B. Related Section:
 - 1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS**2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M), ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

- c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
- 6. Copper Push-on-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) NVent LLC.
 - b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.

2.03 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.04 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.05 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.06 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.

- b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Description:
 - a. Electroplated steel nipple.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.07 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.08 WATER METERS

- A. Displacement-Type Water Meters:
 - 1. Description:
 - a. Standard: AWWA C700.
 - b. Pressure Rating: 150-psig working pressure.
 - c. Body Design: Nutating disc; totalization meter.
 - d. Registration: In gallons or cubic feet as required by utility.
 - e. Case: Bronze.
 - f. End Connections: Threaded.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in

Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. 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.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping adjacent to equipment and specialties to allow service and maintenance.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- T. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- U. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. 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:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.05 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.06 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.07 FLEXIBLE CONNECTOR INSTALLATION

- A. Install bronze-hose flexible connectors in copper domestic water tubing.
- B. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.08 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation, according to utility company's requirements.
- B. Water meters will be furnished and installed by utility company.
- C. Install water meters according to AWWA M6, utility company's requirements, and the following:
- D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
- E. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
- F. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.09 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.13 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller shall be the following:
 1. Hard copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.

3.15 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 1119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL**1.01 SUMMARY**

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water hammer arresters.
 - 11. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.

1.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 60 psig, unless otherwise indicated.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS**2.01 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Plumbing Products Group; Wilkins Div.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Conbraco Industries, Inc.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.

5. Inlet and Outlet Connections: Threaded.
 6. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Plumbing Products Group; Light Commercial Operation.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Conbraco Industries, Inc.
 - d. MIFAB, Inc.
 - e. Woodford Manufacturing Company.
 2. Standard: ASSE 1001.
 3. Body: Bronze, nonremovable, with manual drain.
 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 5. Finish: **Rough bronze**.

2.02 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Industries, Inc.; Water Products Div.
 - b. Zurn Plumbing Products Group; Wilkins Div.
 - c. Conbraco Industries, Inc.
 - d. Honeywell Water Controls.
 2. Standard: ASSE 1012.
 3. Operation: Continuous-pressure applications.
 4. Size: NPS 3/4.
 5. Body: Bronze.
 6. End Connections: Solder joint.
 7. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Industries, Inc.; Water Products Div.
 - b. Zurn Plumbing Products Group; Wilkins Div.
 - c. Conbraco Industries, Inc.
 2. Standard: ASSE 1013.
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
 5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 7. Configuration: Designed for horizontal, straight through flow.
 8. Accessories:

- a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
- b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.03 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Plumbing Products Group; Wilkins Div.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Conbraco Industries, Inc.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.04 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell and Gossett
 - b. Conbraco Industries, Inc.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.05 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Powers; a Watts Industries Co.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Leonard Valve Company.
 - e. Symmons Industries, Inc.

- f. Taco, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1017.
- 3. Pressure Rating: 125 psig.
- 4. Type: Thermostatically controlled water mixing valve.
- 5. Material: Bronze body with corrosion-resistant interior components.
- 6. Connections: Threaded union inlets and outlet.
- 7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
- 8. Tempered-Water Setting: 120 deg F.
- 9. Valve Finish: Chrome plated.
- B. Primary, Thermostatic, Water Mixing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Powers; a Watts Industries Co.
 - b. Leonard Valve Company.
 - c. Symmons Industries, Inc.
 - 2. Standard: ASSE 1017.
 - 3. Pressure Rating: 125 psig.
 - 4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
 - 5. Material: Bronze body with corrosion-resistant interior components.
 - 6. Connections: Threaded union inlets and outlet.
 - 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 - 8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 9. Tempered-Water Setting: 120 deg F.
 - 10. Valve Finish: Rough bronze.
 - 11. Piping Finish: Copper.
 - 12. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

2.06 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
 - 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
 - 5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - 6. Drain: Factory-installed, hose-end drain valve.

2.07 HOSE BIBBS

- A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.08 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Plumbing Products Group; Light Commercial Operation. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for concealed and exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

B. Moderate-Climate Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Zurn Plumbing Products Group; Light Commercial Operation.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Drainage Products Inc.
 - f. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for concealed and exposed-outlet, self-draining wall hydrants.
 3. Pressure Rating: 125 psig.
 4. Operation: Loose key.
 5. Inlet: NPS 3/4.
 6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
 7. Box: Deep, flush mounting with cover.
 8. Box and Cover Finish: Chrome plated.
 9. Outlet: Exposed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
 10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 11. Operating Keys(s): Two with each wall hydrant.
- C. Vacuum Breaker Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Plumbing Products Group; Light Commercial Operation.
 - b. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Woodford Manufacturing Company.
 2. Standard: ASSE 1019, Type A or Type B.
 3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
 4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
 5. Pressure Rating: 125 psig.
 6. Operation: Loose key.
 7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 8. Inlet: NPS 3/4.
 9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.09 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 2. Pressure Rating: 400-psig minimum CWP.
 3. Size: NPS 3/4.
 4. Body: Copper alloy.

5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. AMTROL, Inc.
 - e. Josam Company.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Watts Drainage Products Inc.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
- G. Install water hammer arresters in water piping according to PDI-WH 201.
- H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Intermediate atmospheric-vent backflow preventers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Water pressure-reducing valves.
 - 5. Primary, thermostatic, water mixing valves.
 - 6. Supply-type, trap-seal primer valves.
- K. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.03 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

NOT FOR BID

SECTION 22 1316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
- B. Related Section:
 - 1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS**2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Dallas Specialty & Mfg. Co.
 - c. Fernco Inc.
 - d. Matco-Norca, Inc.
 - e. MIFAB, Inc.
 - f. Mission Rubber Company; a division of MCP Industries, Inc.
 - g. Stant.
 - h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - g. Tyler Pipe.
 2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.03 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.04 ABS PIPE AND FITTINGS

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
- C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- D. Solvent Cement: ASTM D 2235.
 1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.

- 3) Mission Rubber Company; a division of MCP Industries, Inc.
- 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
- b. Standard: ASTM C 1173.
- c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.02 PIPING INSTALLATION

- A. 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.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and

reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 2 percent down toward vertical fixture vent or toward vent stack.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- N. Install underground ABS piping according to ASTM D 2321.
- O. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
 2. In Drainage Piping: **Unshielded**, nonpressure transition couplings.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Install hangers for ABS piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
- K. Install supports for vertical ABS piping every 48 inches.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.07 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 1. Solid wall Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
- E. Aboveground condensate drain:
 1. Copper DWV tube, copper drainage fittings, and soldered joints.

END OF SECTION

SECTION 22 1319
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL**1.01 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains, floor sinks.
 - 3. Miscellaneous sanitary drainage piping specialties.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.03 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS**2.01 CLEANOUTS**

- A. Exposed Cast-Iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.

3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Extra Heavy Duty.
13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.02 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Plumbing Products Group; Light Commercial Operation.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.

8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Top Loading Classification: Heavy Duty.
16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
17. Trap Material: Cast iron.
18. Trap Pattern: Standard P-trap.
19. Trap Features: Trap-seal primer valve drain connection.

B. Cast-Iron Floor Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Light Commercial Operation.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor sink.
4. Body Material: Cast iron.
5. Outlet: Bottom.
6. Backwater Valve: Not required.
7. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
8. Sediment Bucket: Not required.
9. Top Shape: Square.
10. Top Loading Classification: Light Duty.
11. Funnel: Not required.
12. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
13. Trap Material: Cast iron.
14. Trap Pattern: Standard P-trap.
15. Trap Features: Trap-seal primer valve drain connection.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Garbage Disposal.
1. Manufacturers:
 - a. In-sink-erator.
 - b. Approved equivalent.

2. Continuous feed, ½ HP induction motor, cast nickel chrome alloy cutting elements, stainless steel grind chamber, stainless steel and chrome plated finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- G. Install vent caps on each vent pipe passing through roof.
- H. Install interceptors, including trapping, and venting according to authorities having jurisdiction and with clear space for servicing.
 1. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Interceptors: Connect inlet and outlet to unit, and connect vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.03 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 1513
GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig or less.
- B. See Division 22 Section "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Compressed-air piping and support and installation shall withstand effects of seismic events determined according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pressure regulators. Include rated capacities and operating characteristics.
 - 2. Automatic drain valves.
 - 3. Filters. Include rated capacities and operating characteristics.
 - 4. Lubricators. Include rated capacities and operating characteristics.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS**2.01 PIPES, TUBES, AND FITTINGS**

- A. Copper Tube: ASTM B 88, Type K or L seamless, drawn-temper, water tube.
 - 1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
 - 2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
 - 3. Copper Unions: ASME B16.22 or MSS SP-123.
- B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.02 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch maximum thickness.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.03 VALVES

- A. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

2.04 DIELECTRIC FITTINGS

- A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Dielectric Unions: Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F

2.05 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.06 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
- C. Air-Line Pressure Regulators: Diaphragm operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.
- D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.
- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.
- F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

2.07 QUICK COUPLINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroquip Corporation; Eaton Corp.
 - 2. Bowes Manufacturing Inc.
 - 3. Foster Manufacturing, Inc.
 - 4. Milton Industries, Inc.
 - 5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.

6. Rectus Corp.
 7. Schrader-Bridgeport; Amflo Div.
 8. Schrader-Bridgeport/Standard Thomson.
 9. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
 10. TOMCO Products Inc.
 11. Tuthill Corporation; Hansen Coupling Div.
- B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 2. Plug End: Check-valve Straight-through type with barbed outlet for attaching hose.
- D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
 2. Plug End: With barbed outlet for attaching hose.

2.08 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
1. Hose: Reinforced single-wire-braid, CR-covered hose for compressed-air service.
 2. Hose Clamps: Stainless-steel clamps or bands.
 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:
1. NPS 2 and Smaller: Type L, copper tube; wrought-copper fittings; and brazed joints.
- B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
1. NPS 2 and Smaller: Type L, copper tube; wrought-copper fittings; and brazed or soldered joints.
- C. Drain Piping: Use the following piping materials:
1. NPS 2 and Smaller: Type L (Type B) copper tube; wrought-copper fittings; and brazed or soldered joints.

3.02 VALVE APPLICATIONS

- A. Comply with requirements in "Valve Applications" Article in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. 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 otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
 - 1. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."
- K. Install piping to permit valve servicing.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- O. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.04 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.
- D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- G. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.05 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.06 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.07 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.08 SPECIALTY INSTALLATION

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated.
- F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.
- G. Install quick couplings at piping terminals for hose connections.
- H. Install hose assemblies at hose connections.

3.09 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.

- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- I. Install supports for vertical, Schedule 40, steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
 - 7. NPS 2: 11 feet with 3/8-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.

3.10 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.11 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect filters, lubricators and pressure regulators for proper operation.

END OF SECTION

SECTION 22 1519**GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Lubricated, reciprocating air compressors.
 - 2. Inlet-air filters.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design compressed-air equipment mounting, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Seismic Performance: Compressed-air equipment shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. 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."

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- B. Delegated-Design Submittal: For compressed-air equipment mounting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of supports.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
- C. Seismic Qualification Certificates: For compressed-air equipment, accessories, and components, from manufacturers.
- D. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. 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.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS**

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - 2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
 - 3. Control Voltage: 120-V ac or less, using integral control power transformer.

4. Motor Overload Protection: Overload relay in each phase.
 5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 6. Automatic control switches to alternate lead-lag compressors for duplex air compressors.
 7. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
 8. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.
- C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 2. Interior Finish: Corrosion-resistant coating.
 3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.
- D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.02 LUBRICATED, RECIPROCATING AIR COMPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ingersoll-Rand; Air Solutions Group.
 2. Kaeser Compressors, Inc.
 3. Gardner Denver, Inc.
- B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
1. Submerged gear-type oil pump.
 2. Oil filter.
 3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 4. Belt guard totally enclosing pulleys and belts.
- C. Capacities and Characteristics:
1. Air Compressor(s): One; two stage.
 - a. Intercooler between stages of two-stage units.
 2. Discharge-Air Pressure: 100 psig
 3. Receiver: ASME construction steel tank.
 - a. Arrangement: Vertical.
 - b. Capacity: 80 gal.
 - c. Interior Finish: Epoxy or galvanized coating.
 - d. Pressure Rating: 100 psig minimum.
 - e. Drain: Automatic valve.

2.03 INLET-AIR FILTERS

- A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.
1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.

2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.
- B. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.
 1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
 2. Capacity: Match total capacity of connected air compressors, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

2.04 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Equipment Mounting: Install air compressors, aftercoolers, and air dryers on concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 1. Minimum Deflection: 1/4 inch.
- B. Equipment Mounting: Install air compressors, aftercoolers, and air dryers using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 1. Minimum Deflection: 1/4 inch.
- C. Equipment Mounting: Install air compressors, aftercoolers, and air dryers on vibration isolation inertia bases. Comply with requirements specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Equipment Mounting: Install air compressors, aftercoolers, and air dryers on concrete bases. Comply with requirements in Division 03 Section "Miscellaneous Cast-in-Place Concrete."
- E. Install compressed-air equipment anchored to substrate.
- F. Install the following devices on compressed-air equipment:
 1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
 2. Pressure Regulators: Install downstream from air compressors and dryers.
 3. Automatic Drain Valves: Install on receivers. Discharge condensate over nearest floor drain.
- G. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Check for lubricating oil in lubricated-type equipment.
 3. Check belt drives for proper tension.
 4. Verify that air-compressor inlet filters and piping are clear.
 5. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.

6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure but not higher than rating of system components.
7. Check for proper seismic restraints.
8. Drain receiver tanks.
9. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
10. Test and adjust controls and safeties.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

3.03 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air compressors, aftercoolers, and air dryers.

END OF SECTION

SECTION 22 3400
FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. 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."

1.03 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
- D. Product certificates.
- E. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Operation and maintenance data.
- I. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

- A. 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.
- B. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.

- a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: One year(s).
- b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - 2. Standard: ANSI Z21.10.3/CSA 4.3.
 - 3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - 5. Special Requirements: NSF 5 construction.
 - 6. Manufacturer's concentric vent kit.

7. Automatic Damper: ANSI Z21.66/CSA 6.14-M, electrically operated, automatic-vent-damper device with size matching draft hood.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. Flexcon Industries.
 - c. Honeywell International Inc.
 - d. Pentair Pump Group (The); Myers.
 - e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - f. Taco, Inc.
2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 100 psig.
 - b. Capacity Acceptable: 2 gal. minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

I. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

J. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

- K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.
- E. See section 23 08 00 for commissioning requirements for domestic hot water system.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete".
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
 - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.

4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23 Section "Facility Natural-Gas Piping."
- D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Division 23 Section "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and

reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

- C. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION

NOT FOR BID

SECTION 22 4213.13
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Water closets.
 - 2. Toilet seats.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS**2.01 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS**

- A. Water Closets: Floor mounted, bottom outlet, top spud.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - c. Kohler Co.
 - 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Close-coupled tank type.
 - e. Height: Disabled/elderly, complying with CBC Section 1115B.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White.
 - 3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.

2.02 TOILET SEATS

- A. Toilet Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Olsonite Seat Co.
 - b. Centoco Manufacturing Corporation.
 - c. Bemis Manufacturing Company.
 - d. Church Seats.
 - e. Kohler Co.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Water-Closet Installation:
 1. Install level and plumb according to roughing-in drawings.
 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- C. Install toilet seats on water closets.
- D. Wall Flange and Escutcheon Installation:
 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 2. Match sealant color to water-closet color.
 3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.02 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.03 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.04 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.

- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

NOT FOR BID

**SECTION 22 4216.13
COMMERCIAL LAVATORIES**

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Lavatories.
 - 2. Faucets.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS**2.01 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES**

- A. Lavatory: Oval, self rimming, vitreous china, counter mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - c. Kohler Co.
 - 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Self-rimming for above-counter mounting.
 - c. Nominal Size: Oval, 20 by 17 inches.
 - d. Nominal Size: Round, 19 inches.
 - e. Faucet-Hole Punching: Three holes, 2-inch centers.
 - f. Faucet-Hole Location: Top.
 - g. Color: White.
 - h. Mounting Material: Sealant.

2.02 SOLID-BRASS, MANUALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, single-control mixing, solid-brass valve.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. American Standard America.

- c. Moen Incorporated.
- d. Kohler Co.
- 2. Standard: ASME A112.18.1/CSA B125.1.
- 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
- 4. Body Type: Centerset.
- 5. Body Material: Commercial, solid brass.
- 6. Finish: Polished chrome plate.
- 7. Maximum Flow Rate: 0.4 gpm.
- 8. Mounting Type: Deck, exposed.
- 9. Valve Handle(s): Single lever.
- 10. Spout: Rigid type.
- 11. Spout Outlet: Aerator.
- 12. Operation: Compression, manual.
- 13. Drain: Not part of faucet.

2.03 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 1/2.
 - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.04 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated, brass or steel wall flange.
 - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- C. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

**SECTION 22 4216.16
COMMERCIAL SINKS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Utility sinks.
 - 2. Sink faucets.
 - 3. Supply fittings.
 - 4. Waste fittings.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS**2.01 UTILITY SINKS**

- A. Service Sinks: Enameled, cast iron, floor mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CECO Sinks.
 - b. American Standard America.
 - c. Commercial Enameling Company.
 - d. Gerber Plumbing Fixtures LLC.
 - e. Kohler Co.
 - 2. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Style: With front apron and raised back.
 - c. Nominal Size: 28 by 28 inches.
 - d. Color: White.
 - e. Drain: Grid with NPS 3 outlet.
 - f. Rim Guard: Coated wire.
- B. Utility Sinks: Stainless steel, counter mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Just Manufacturing.
 - b. Advance Tabco.
 - c. Eagle Group; Foodservice Equipment Division.
 - d. Elkay Manufacturing Co.
 - 2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Type: Ledge back.

- c. Number of Compartments: One or Two.
- d. Metal Thickness: 0.050 inch
- e. Each Compartment:
 - 1) Drains: NPS 1-1/2 tailpiece with stopper.
 - 2) Drain Location: Centered in compartment.

2.02 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: Manual type, single-control mixing valve.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. Elkay Manufacturing Co.
 - c. Just Manufacturing.
 - d. Moen Incorporated.
 - e. T & S Brass and Bronze Works, Inc.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 - 4. Body Type: Centerset.
 - 5. Body Material: Commercial, solid brass.
 - 6. Finish: Polished chrome plate
 - 7. Maximum Flow Rate: 2.2 gpm.
 - 8. Handle(s): Lever
 - 9. Mounting Type: Deck, exposed.
 - 10. Spout Outlet: Aerator.

2.03 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 1/2
 - 2. ASME A112.18.6, braided flexible hose.

2.04 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:

1. Size: NPS 1-1/2.
2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Install water-supply piping with stop on each supply to each sink faucet.
 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 2. Install stops in locations where they can be easily reached for operation.
- E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- F. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.

- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

NOT FOR BID

SECTION 22 4223
COMMERCIAL SHOWERS, RECEPTORS, AND BASINS

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Shower faucets.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS**2.01 SHOWER FAUCETS**

- A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.
- B. Shower Faucets:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Chicago Faucets.
 - c. Symmons.
 - d. Moen Incorporated.
 - 2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
 - 3. Faucet:
 - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
 - e. Mounting: Concealed.
 - f. Operation: Single-handle, twist or rotate control.
 - g. Antiscald Device: Integral with mixing valve.
 - h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - 4. Supply Connections: NPS 1/2 (DN 15).
 - 5. Shower Head:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Type: Ball joint with arm and flange.
 - c. Shower Head Material: Metallic with chrome-plated finish.
 - d. Spray Pattern: Adjustable.
 - e. Integral Volume Control: Not required.
 - f. Shower-Arm, Flow-Control Fitting: Not required.
 - g. Temperature Indicator: Not required.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Assemble shower components according to manufacturers' written instructions.
- B. Install showers level and plumb according to roughing-in drawings.
- C. Install water-supply piping with stop on each supply to each shower faucet.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with shower. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- D. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- E. Set shower receptors in leveling bed of cement grout.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.02 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with traps and soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.03 ADJUSTING

- A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.04 CLEANING AND PROTECTION

- A. After completing installation of showers, inspect and repair damaged finishes.
- B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 0000
GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. The General conditions, supplementary conditions, special Requirements, and applicable portions of Division 1 of the specification are a part of this Division and the requirements contained herein are supplementary to them.
- B. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 ABBREVIATIONS AND DEFINITIONS (as used on Division 23 Drawings and herein)

- A. This Division is abbreviated and includes incomplete sentences. Supply omitted words by inference.
- B. Symbols: "S" means submittals are required; "M/O" means Maintenance/Operating data is required; see paragraphs hereinafter.
- C. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- D. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- E. "Ductwork" means ducts, plenums, compartments, casings or any like devices, including the building structure, which are used to convey or contain air.
- F. "Extend", "Submit", "Repair", "Abandon", "Replace", "Remove" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- G. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constructed authorities and public utility franchise holders having jurisdiction.
- H. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- I. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces which are not included in the utility areas definition.
- J. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- K. "Below Grade" means buried in the ground.
- L. "Substantial Mechanical Completion" means all components of all systems are functioning but lacking in final adjustment.
- M. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid which the device will serve.

1.03 DESCRIPTION

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.04 RELATED WORK

- A. Coordination: Refer to Architectural, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of mechanical work in relation to the work of other Divisions.

- B. Examine other Divisions for work related to the work of this Division, especially Division 26 - ELECTRICAL.

1.05 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or the specifications, request clarification.
- B. The Architect shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflict not clarified prior to Bidding deadline, use the costliest alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

1.06 PERMITS AND INSPECTIONS

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.07 CODES AND REGULATIONS

- A. By submitting a bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract documents and the Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specify references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted)
 - 1. All local codes; city and/or County as applicable
 - 2. OSHA requirements
 - 3. California Building Code
 - 4. California Mechanical Code
 - 5. California Plumbing Code
 - 6. California Code of Regulations (CCR) Titles
 - 7. Fire Marshal Regulations
 - 8. Regulations of all other authorities having jurisdiction.
- C. Where conflict or variation exists among codes, the most stringent shall govern.
- D. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- E. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of

materials and equipment, submit certified copies of test reports specified in the individual sections.

- F. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- G. Permits and Certificates of Inspection: Furnish the originals.
- H. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- I. Other data required by other sections of this Division. Furnish 2 copies.

1.08 RECORD AND DOCUMENTATION

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work:

- 1. Record (As-Built) Drawings:

- a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
- b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
- c. Furnish the originals.

- 2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated mechanical systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent, shall be provided to the Architect in accordance with the Division 1 section on Maintenance and Operation Manuals. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL

PROJECT TITLE.....

CONTRACTOR.....

Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:

- a. Updated approved materials list, shop drawings and catalog information of all items indicated by symbol "M/O" at titles or beginning of paragraphs.
- b. System layout showing piping, valves and controls.
- c. Wiring and control diagrams with data to explain detailed operation and control of each component.
- d. A control sequence describing start-up, operation and shutdown.
- e. Detailed description of the function of each principal component of the system.
- f. Procedure for starting.
- g. Procedure for operation.
- h. Shut-down instruction.
- i. Installation instructions.
- j. Adjustments, maintenance and overhaul instructions.
- k. Lubrication schedule including type, grade, temperature range and frequency.

- l. Safety precautions, diagrams and illustrations.
 - m. Test procedures.
 - n. Performance data.
 - o. Parts lists, with manufacturer's names and catalog numbers.
 - p. Preventive maintenance schedule.
 - q. Service organization with name, address and telephone number.
 - r. Valve identification chart and schedule.
 - s. ASME certification
 - t. Air Balance report.
- B. Standard Compliance: Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards (ANSI), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Underwriters Laboratories (UL), American Refrigeration Institute (ARI), American Gas Association (AGA), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

1.09 TOOLS

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.10 CONSTRUCTION COST BREAKDOWN

- A. To assist the Architect and Engineer in evaluation of the construction cost, the Contractor shall prepare and submit for review a construction cost breakdown for the major subdivisions of the mechanical work.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Cost breakdowns shall be submitted and approved prior to the first payment request. Send one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- B. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted as a substitution by the Architect. Where three or more manufacturers are listed as "acceptable manufacturers" however, then the products furnished shall be the product of one of the manufacturers listed. Manufacturers listed as "acceptable manufacturers" shall meet quality and performance of a particular one specified by both name and catalog number.

2.02 SUBSTITUTIONS

- A. General: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the Architect's request. If in the Architect's opinion the products as presented in this first submittal are in variance with the specified products, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified products shall be furnished. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any changes (whether architectural, structural, electrical or mechanical) necessary to accommodate the substitution.
- B. Specific: Refer to other sections of this Division for additional requirements.

2.03 SUBMITTALS

- A. General:
 - 1. Provide for all items indicated with the symbol "S" at titles or beginning of paragraphs in accordance with the Division 1 section covering submittals and as herein specified. Where warranty of longer than one year is specified, include such warranty with submittal. Architect's review of the submittal is only for general conformance with design compliance with the information given in the contract documents. The submittal procedure is required as an effort to minimize the problems which occur due to the discovery of Contractor non-compliance at the construction site. The Contractor is responsible for conformation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all Divisions of the work. Deviations, if any, from Contract documents shall be clearly and completely indicated (by a separate letter if deviations are extensive) in the submittals, and the lack of such is deemed complete compliance with Contract Documents without any deviations. Submittals favorably processed will not relieve the Contractor of responsibility for deviations not so reported nor for errors in the submittal.
 - 2. In addition to the above, upon permission to proceed after review of submittal and prior to the installation of work, submit dimensioned and scaled drawings (not less than 1/4-inch equal to one foot) of all mechanical equipment rooms and areas. Such layouts shall indicate, but not be limited to, all mechanical equipment, control panels, piping, housekeeping pads, ductwork, tube pull, access and maintenance clearances, and other like items. The layout shall also indicate major equipment to be provided under other Sections of work.

3. Contractor Stamp: All submittals shall be stamped with the following text and signed by the Contractors representative:

"IT IS HEREBY CERTIFIED THAT THE PRODUCTS SHOWN AND MARKED IN THIS SUBMITTAL ARE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND CAN BE INSTALLED IN THE ALLOCATED SPACES EXCEPT WHERE NOTED AS DEVIATIONS.

CERTIFIED BY:----- DATE:-----

4. All submittals shall be complete and with catalog data and information properly marked to show, among other things, equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities of performance as specified or indicated. Arrange the submittals in the same sequence as these specifications, and reference (at the upper right-hand corner) the particular specification provision for which each submittal is intended. Incomplete submittals will be rejected.
 5. For all work under Division 23, the notations by the Contractor or Supplier on submittal documents "Per Plans and Specifications", or "As Specified", or similar wording or phrasing is not acceptable and will be cause of rejection. Complete descriptive submittals are required for all Division 23 work.
 6. Refer to the other sections of this Division for specific requirements.
- B. Material List: Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.
 - C. Shop Drawings: Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the Owner's representative.
 - D. Other Submittals: As required by other sections of this Division.

PART 3 EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in the best standard practice of the trade.
- B. Execute the work to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned, and firmly secured in place.
- C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TESTS

- A. General:
 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings,

and shop fabricated ductwork.

- D. Keep cabinets and other openings closed to prevent entry of foreign matter.

3.04 CLEANUP AND HOUSEKEEPING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Leave exposed parts of the mechanical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

3.05 PROJECT CONDITIONS

- A. Site Examinations and Conditions:
 - 1. Regard information relative to existing conditions, services and structure as approximate only. Verify dimensions and locations and be knowledgeable of all working conditions before submitting Bid. Verify pressure, location, size, and elevation of existing services (to which points of connection are to be made or crossed) as soon as possible and prior to commencement of any new work.
 - 2. Make minor deviations necessary to conform to actual locations and conditions. Submission of Bid presumes proper examination of Site, locations, dimensions and conditions, and no additional cost will be honored for lack of such examinations.
- B. Access and Placement of Work:
 - 1. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and re-assembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
 - 2. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. If Mechanical Drawings do not indicate exact locations, or conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.
- C. Verification and Coordination: Drawings indicating suggested distribution routes are diagrammatic only, and all scaled and figured dimensions are approximate and are indicated for estimating purposes only. The Drawings do not indicate necessary offsets and like items. Do not construe Contract Drawings as fabrication drawings. Prior to fabrication and installation of work, verify all dimensions, sizes and distribution routes with actual conditions, and prepare submittal and fabrication drawings. Coordinate to avoid possible conflicts and resolve same where such exist. Install work to conform to structure, avoid obstruction, preserve headroom, and keep openings and passageway clear. Changes necessary, resulting from such verification and coordination, shall not be a cause for additional cost.

3.06 WARRANTY

- A. Guarantee, in writing, all work against fault of any product or workmanship for a period of not less than one year after formal acceptance by the Owner; except, where longer periods are specified in the Specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components that are inactive because of said failure shall be suspended. The warranty period for such component shall resume running for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- B. Neither payments for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.

3.07 SAFETY REQUIREMENTS

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts in accordance with the OSHA 1910.219. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

3.08 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish printed copies of these recommendations to the installing Contractor and Architect prior to installation. Do not proceed with the installation of the item until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

END OF SECTION

SECTION 23 0500
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. The contract documents shall apply in their entirety to the work specified herein.
- B. Submittals: Submit shop drawings and manufacturer's data on each item marked [S] in accordance with the Division 1 section on submittals and Section 23 0000, Basic Mechanical Requirements.
- C. Maintenance and Operation Manuals: Provide manufacturer's maintenance and operation manuals on each item marked [M/O] in accordance with the Division 1 section on maintenance and operation manuals and Section 23 0000, Basic Mechanical Requirements.

PART 2 PRODUCTS

2.01 ELECTRICAL MOTORS [S] [M/O]

- A. Provide all motors indicated on drawings necessary for equipment under the Mechanical Work. See electrical drawings for voltage and phase of electrical services.
- B. Unless otherwise specified, all motors 1/2 HP or larger: heavy duty, ball bearing, squirrel cage induction type in drip proof or splash proof enclosure, 1.15 service factor, and shall be suitable for the voltage system specified or indicated. Motor speed shall not exceed 1750 rpm unless otherwise indicated or specified. Motors exposed outdoors: either epoxy encapsulated winding or TEFC enclosure.
- C. Each motor shall have sufficient starting torque to start the apparatus driven.
- D. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives. All motors shall have a nameplate voltage rating of the specified operating voltage.
- E. Provide overload protection on single phase motors.
- F. Motors rated 1 HP and larger shall have shaft, bearings, and etc. capable of operating with multiple grooved sheaves and two or more belts.
- G. Provide with nameplates permanently attached to exterior housing with manufacturer's name and all electrical characteristics specified thereon.
- H. Brake horsepower shall not exceed 90% of rated motor horsepower.
- I. Motors shall be Lincoln, Westinghouse, General Electric, or approved equivalent.

2.02 MOTOR STARTERS [S] [M/O]

- A. See Electrical Drawings for voltage and phase of electrical services.
- B. Starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.
- C. Enclosure: NEMA 1 (unless location of starters dictates otherwise) of sufficient size to contain all accessories specified.

2.03 BELT DRIVES [S] [M/O]

- A. V Type. Drives requiring not more than 2 belts: variable pitch type; size for mid-point of operating range. Drives requiring 3 or more belts: nonadjustable constant speed type. Provide belts in matched sets.
- B. All belt drives shall have a minimum rating of 1.5 times the motor nameplate horsepower rating.

2.04 BELT AND DRIVE GUARDS [S]

- A. Provide all rotating equipment drives and couplings with suitable guards.
- B. Drive guards shall be as standard by the equipment manufacturer.
- C. Belt guards shall be as standard by the equipment manufacturer.

2.05 EQUIPMENT IDENTIFICATION [S]

- A. Identify equipment in accordance with 23 0553 Identification for HVAC Piping and Equipment.

2.06 PRIMERS AND PAINTS [S]

- A. All equipment furnished under Division 15, unless otherwise noted, shall be furnished with a factory applied prime coat.
- B. Where field priming or touch-up priming is required, primer shall be as follows for ferrous metal surfaces:
1. Metal Surfaces, Not Galvanized: Latex, corrosion resistant primer suitable for metal surfaces or Epoxy-polyamide, green primer paint, formula 150, type I (QPL).
 2. Metal Surfaces, Galvanized: Galvanized repair compound with high zinc dust content; ZRC Cold Galvanizing Compound, or approved equivalent (no known equivalent).
- C. Finish painting of Mechanical equipment furnished under Division 15: See Section 09 9000 - Paints and Coatings.
1. Non-metallic surfaces: Latex (Acrylic Emulsion, Exterior Wood and Masonry) Paint.

2.07 SEALANTS [S]

- A. Non-fireproof Penetrations: Silicone rubber sealant; DowCorning 785/4, or approved equivalent.
- B. Fireproof Penetrations: Sealant shall comply with ASTM-E-814 (UL 1479 or UL 94); 3M Brand Fire Barrier Penetration Sealing System with CP-25 caulk, or approved equivalent.

2.08 SEALANTS, WATERSTOP

- A. Cold applied, pre-formed, plasticized, waterstop sealing compound consisting of blends of refined hydrocarbon resins and plasticizing compounds; Synko-Flex Waterstop and Primer, or approved equivalent (no known equivalent).

2.09 BOLTED MECHANICAL SEALS [S]

- A. Seals shall be modular, bolted, mechanical link type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Tightening of the bolts shall cause the rubber sealing elements to expand to form a water-tight seal between the pipe and the sleeve; Thunderline "Link-Seal" Model LS, or approved equivalent.

PART 3 EXECUTION**3.01 GENERAL**

- A. Install products in accordance with product manufacturer's recommendations. After installation of systems and until formal acceptance of systems by the Owner, be responsible for operation and maintenance of systems.

3.02 ELECTRICAL WORK

- A. Coordinate with Division 26. See Division 26 Contract Documents for voltage and phase of electrical services.
- B. All power wiring and conduits for same serving motors, and where indicated on Division 26 Contract Drawings, to mechanical control panels, separate or equipment mounted, shall be provided under Division 26.
- C. The following shall be provided under Division 23:
1. Pre-wired mechanical control panels.
 2. All automatic or temperature control and interlock wiring, regardless of voltage, and conduits for same necessary for proper operation of equipment under Division 23. This includes interlock wiring between motor starter coils, interlocking relays, contactors, mechanical equipment control panels, temperature control devices, and temperature control panels.
 3. Power wiring and conduits for same not indicated on the Division 26 Contract Drawings to

mechanical control panels (separate or equipment mounted).

- D. Install all wiring under Division 23 in rigid conduit or electrical metallic tubing indoors and in rigid conduit outdoors. All such wiring shall be concealed.

3.03 BELT DRIVES

- A. Select drives for proper speed required for conditions indicated. Conditions indicated are estimated conditions and may vary under actual operating conditions. To adjust speed for actual operating conditions, change drive as often as necessary, at no additional cost.

3.04 FLASHING

- A. Flash and counter flash with metal to make waterproof all penetrations through roofs or exterior walls. Roof flashing shall have a minimum 8-inch skirt. The metal flashing and counterflashing shall be the same material as the equipment to which they are attached. Factory-fabricated flashing may be used for piping. Prior to any interior finish work, test the integrity of all flashing with water hose.

3.05 EQUIPMENT INSTALLATION

- A. Install equipment where shown, as indicated, and in accordance with the manufacturer's recommendations for the specific service.
- B. Provide anchor bolts, setting Drawings and templates for setting equipment.
- C. Assure correct alignment of equipment after setting.
- D. Where grouting is necessary, use non-shrink type.
- E. Before bolting any equipment coat threads with an anti-seize and lubricating compound. Do not use powder driven anchors unless written permission has been obtained from the Architect.
- F. Provide all exposed moving or rotating parts of machines with guards in compliance with OSHA requirements. Install all guards in removable sections, if necessary, and with studs and wing nuts for removal of same in maintenance. Make provision for RPM readings on guards covering end of shafts; enclose fan belts at both sides of belts.

3.06 MAINTENANCE AND ACCESS TO EQUIPMENT

- A. Where valves, dampers, control devices, coils, or other like devices (i.e, plumbing P-trap, water hammer arresters, gauges, thermometers) requiring maintenance, checking or readings are inaccessibly concealed in walls or ceilings, and where indicated, provide square or rectangular access doors. Where space permits, doors for ceiling installation shall not be less than 18-inches by 18-inches. Prior to installation, verify all access locations.
- B. Where there are lubrications within equipment, extend such to exterior of equipment.

3.07 REVIEW OF WORK

- A. Do not allow or cause any mechanical work to be covered, concealed or enclosed until such work has been tested and reviewed. Should such work be covered, concealed or enclosed before being tested and reviewed, such shall be uncovered and thereafter restored at no additional cost.

3.08 EQUIPMENT IDENTIFICATION

- A. Manufacturer's Nameplates: Provide all equipment with manufacturer's nameplates secured to the respective equipment and indicating, but not being limited to, the manufacturer's name, model, size, serial number, capacity and electrical characteristics. Clean, polish and protect all such nameplates with a coat of clear protective finish.
- B. Equipment Tags: Identify all equipment (such as machinery, motor starters, control panels, pushbuttons and other like devices) exposed to view with identification tags in accordance with 23 0553.

3.09 PRIMING, PAINTING, AND COATING

- A. Properly clean surfaces to be touched up of rust, dirt, scale, wax and other deleterious materials. Prime surfaces. Touch up with like material all damaged galvanized or factory-primed

metal surfaces. Do not prime over manufacturer's nameplates on equipment.

- B. Coat all bare steel parts of piping accessories below grade with coats of coal-tar based bituminous mastic.
- C. Except for factory priming, factory finish painting and otherwise specified under this Article, all field priming (except touch up) and finish painting shall be under other Divisions.
- D. Paint flat black interior surfaces of all concealed unlined galvanized sheet metal ductwork behind air outlets and inlets.
- E. All exposed insulation surfaces in finished areas shall be ready for finish painting; glue size if necessary.

3.10 CLEANING AND DE-GREASING OF PIPING

- A. General:
 - 1. Clean all piping systems to remove all dirt, grease, scale, foreign substances, etc., as specified in each separate section of the Specifications.
 - 2. Prior to commencing work, submit for approval a complete procedure for cleaning and flushing for each separate piping system. Include flushing source, system inlet flushing pressure and size of inlet and outlet flushing connections with their locations for each system. Install flushing connections at all low points of each piping system to ensure complete flushing of the system.
 - 3. Use air and/or gas blown through the lines of gas and air systems, unless specified otherwise, to prove the piping clean. All other piping systems shall be thoroughly flushed out with water unless specified otherwise.

3.11 TESTS AND ADJUSTMENTS

- A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

END OF SECTION

SECTION 23 0529**HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.
 - 6. Metal framing systems
- B. Related Sections:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
 - 3. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS**2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.06 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION**3.01 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 0548**VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Vibration isolators.
- B. Seismic restraints.

1.02 RELATED SECTIONS

- A. Section 03 3000 - Cast-in-Place Concrete.

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide schedule of vibration isolator type with location and load on each.
- C. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate seismic control measures.
- D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. MW Sausse, Inc.
- B. Kinetics Noise Control, Inc: www.kineticsnoise.com.
- C. Mason Industries: www.mason-ind.com.

2.02 VIBRATION ISOLATORS

- A. Closed Spring Isolators:
 - 1. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 - 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance.
 - 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- B. Restrained Closed Spring Isolators:
 - 1. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 - 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance and limit stops.
 - 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- C. Spring Hanger:
 - 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.

2. Housings: Incorporate rubber hanger with threaded insert.
 3. Misalignment: Capable of 20 degree hanger rod misalignment.
 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- D. Neoprene Pad Isolators:
1. Rubber or neoprene waffle pads.
 - a. Hardness: 30 durometer.
 - b. Thickness: Minimum 1/2 inch.
 - c. Maximum Loading: 50 psi.
 - d. Rib Height: Maximum 0.7 times width.
 2. Configuration: Single layer.
 3. Configuration: 1/2-inch-thick waffle pads bonded each side of 1/4 inch thick steel plate.
- E. Rubber Mount or Hanger: Molded rubber designed for 0.4-inch deflection with threaded insert.
- F. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 2. Elements: Replaceable neoprene, minimum of 0.75-inch-thick with minimum 1/8-inch air gap.
 3. Capacity: 4 times load assigned to mount groupings at 0.4-inch deflection.
 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Bases:
1. Set steel bases for one-inch clearance between housekeeping pad and base.
 2. Adjust equipment level.
- C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- E. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.
- F. Provide seismic snubbers for all equipment, piping, and ductwork mounted on isolators. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance. Other snubbers shall have clearance between 0.15 inch and 0.25 inch.
- G. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:
1. Up to 4 Inches Pipe Size: First three points of support.

3.02 FIELD QUALITY CONTROL

- A. Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Warning Tags.

1.02 SUBMITTAL

- A. Product Data: For each type of product indicated.

PART 2 PRODUCTS**2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160° F
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where

equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160° F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.04 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160° F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.05 STENCILS

- A. Stencils: Prepared with letter sizing according to ASME A13.1 for piping; min. letter height of 1-1/4 inch for ducts; and min letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 1. Stencil material: Fiberboard or metal
 2. Stencil paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray can form.
 3. Identification paint: Exterior acrylic enamel in colors according to ASME 13.1 unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Painting and Coating."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 1. Refrigerant Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.

3.04 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue: For supply ducts.
 2. Yellow: For return ducts.

3. Green: For exhaust ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

NOT FOR BID

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.
- C. Commissioning activities.

1.02 ALLOWANCES

- A. Allowance includes testing, adjusting, and balancing of mechanical systems.

1.03 REFERENCES

- A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.
- B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to the Construction Manager.
 - 2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
 - 4. Include at least the following in the plan:
 - a. Preface: An explanation of the intended use of the control system.
 - b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - d. Identification and types of measurement instruments to be used and their most recent calibration date.
 - e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - f. Final test report forms to be used.
 - g. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.

- 3) Branch/submain proportioning.
- 4) Total flow calculations.
- 5) Rechecking.
- 6) Diversity issues.
- h. Expected problems and solutions, etc.
- i. Criteria for using air flow straighteners or relocating flow stations and sensors.
- j. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
- k. Specific procedures that will ensure that air side is operating at the lowest possible pressures and methods to verify this.
- l. Confirmation of understanding of the outside air ventilation criteria under all conditions.
- m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
- n. Method of checking building static and exhaust fan and/or relief damper capacity.
- o. Proposed selection points for sound measurements and sound measurement methods.
- p. Methods for making coil or other system plant capacity measurements, if specified.
- q. Time schedule for TAB work to be done in phases (by floor, etc.).
- r. Description of TAB work for areas to be built out later, if any.
- s. Time schedule for deferred or seasonal TAB work, if specified.
- t. False loading of systems to complete TAB work, if specified.
- u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
- v. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
- w. Procedures for formal progress reports, including scope and frequency.
- x. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.
- E. Progress Reports.
- F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 1. Submit under provisions of Section 01 3000, Submittals.
 2. Submit to the Construction Manager and HVAC controls contractor within two weeks after completion of testing, adjusting, and balancing.
 3. Revise TAB plan to reflect actual procedures and submit as part of final report.
 4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 5. Provide reports in 3 ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
8. Units of Measure: Report data in I-P (inch-pound) units only.
9. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Owner.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project altitude.
 - j. Report date.
- G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 1. AABC MN-1, AABC National Standards for Total System Balance.
 2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 3. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 2. Having minimum of three years documented experience.
 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
- E. TAB Supervisor Qualifications: Certified by same organization as TAB agency.
- F. TAB Supervisor Qualifications: Professional Engineer licensed in the State in which the Project is located.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Duct systems are clean of debris.
 5. Fans are rotating correctly.
 6. Air outlets are installed and connected.
 7. Duct system leakage is minimized.
 8. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

3.04 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
 2. Discrepancies, deficient or uncompleted work by others.
 3. Contract interpretation requests.
 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of

duct.

- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

3.07 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Fans
 - 2. Air Inlets and Outlets
 - 3. Shop Air Compressor
 - 4. Breathing Air Compressor

3.08 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer
 - 2. Model/Frame
 - 3. HP/BHP
 - 4. Phase, voltage, amperage; nameplate, actual, no load
 - 5. RPM
 - 6. Service factor
 - 7. Starter size, rating, heater elements
 - 8. Sheave Make/Size/Bore
- B. V-Belt Drives:
 - 1. Identification/location
 - 2. Required driven RPM
 - 3. Driven sheave, diameter and RPM
 - 4. Belt, size and quantity
 - 5. Motor sheave diameter and RPM

6. Center to center distance, maximum, minimum, and actual
- C. Air Moving Equipment:
 1. Location
 2. Manufacturer
 3. Model number
 4. Serial number
 5. Arrangement/Class/Discharge
 6. Air flow, specified and actual
 7. Return air flow, specified and actual
 8. Outside air flow, specified and actual
 9. Total static pressure (total external), specified and actual
 10. Inlet pressure
 11. Discharge pressure
 12. Sheave Make/Size/Bore
 13. Number of Belts/Make/Size
 14. Fan RPM
- D. Exhaust Fans:
 1. Location
 2. Manufacturer
 3. Model number
 4. Serial number
 5. Air flow, specified and actual
 6. Total static pressure (total external), specified and actual
 7. Inlet pressure
 8. Discharge pressure
 9. Sheave Make/Size/Bore
 10. Number of Belts/Make/Size
 11. Fan RPM
- E. Air Distribution Tests:
 1. Air terminal number
 2. Room number/location
 3. Terminal type
 4. Terminal size
 5. Area factor
 6. Design velocity
 7. Design air flow
 8. Test (final) velocity
 9. Test (final) air flow
 10. Percent of design air flow

END OF SECTION

**SECTION 23 0713
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct Liner.
- C. Insulation jackets.

1.02 RELATED SECTIONS

- A. Section 099000 - Paints and Coatings: Painting insulation jackets.

1.03 REFERENCES

- A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.
- B. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2002.
- C. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2004.
- D. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.
- E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.
- F. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- G. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 1996 (Reapproved 2002).
- H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Fiber Glass: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.
- B. Insulation: ASTM C 553; flexible, noncombustible blanket.
 - 1. 'K' ('Ksi') value: 0.13 at 75 degrees F, when tested in accordance with ASTM C 518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Sorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
- E. Outdoor Vapor Barrier Mastic:
 - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Tie Wire: Annealed steel, 16 gage.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. Knauf Fiber Glass: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.
- B. Insulation: ASTM C 612; rigid, noncombustible blanket.
 - 1. 'K' ('Ksi') value: 0.13 at 75 degrees F, when tested in accordance with ASTM C 518.
 - 2. Maximum service temperature: 450 degrees F.
 - 3. Maximum Water Vapor Sorption: 5.0 percent.
 - 4. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.
3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
- E. Indoor Vapor Barrier Finish:
 1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
 2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
 1. Lagging Adhesive:
 - a. Compatible with insulation.
- B. Aluminum Jacket: ASTM B 209.
 1. Thickness: 0.020-inch sheet.
 2. Joining: Longitudinal slip joints and 2-inch laps.
 3. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
 4. Metal Jacket Bands: 3/8-inch-wide; 0.015-inch-thick aluminum.

2.05 DUCT LINER

- A. Manufacturers:
 1. Nomaco; 'K-Flex Gray'.
 2. Armacell 'Armaflex'.
 3. Degussa "Solcoustic"
- B. Insulation: Closed cell flexible elastometric sheet.
 1. Apparent Thermal Conductivity: Maximum of 0.24 at 75 degrees F.
 2. Service Temperature: Up to 250 degrees F.
 3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
 4. Thickness as required to meet minimum R-8.0 insulation value.
- C. Adhesive: Waterproof, fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with outdoor jacket.
- E. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. Duct and Plenum Liner Application:
 1. Adhere insulation with adhesive for 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL**1.01 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors.
- B. Related Sections:
 - 1. Division 23 Section "Duct Insulation."
 - 2. Division 23 Section "HVAC Equipment Insulation."

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
- C. Field quality-control reports.

1.03 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 PRODUCTS**2.01 INSULATION MATERIALS**

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 - b. Approved equal
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.

5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
 - d. Approved Equal

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - b. Approved equal.
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; AeroSeal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - e. Approved equal.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 SEALANTS

- A. Joint Sealants:
1. Joint Sealants for Cellular-Glass
 2. Products:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.

- d. Mon-Eco Industries, Inc.; 44-05.
- e. Pittsburgh Corning Corporation; Pittseal 444.
- f. Approved equal.
3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F .
6. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Approved equal.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.

2.05 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - e. Approved equal.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.06 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 1/2-inch-wide with wing seal.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.

- b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 - c. Approved equal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel

PART 3 EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings:
1. Install insulation over fittings with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 FINISHES

- A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

- D. Do not field paint aluminum or stainless-steel jackets.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two locations of straight pipe, three locations of threaded fittings for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, thickness per CEC Table 120.3-A.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, thickness per CEC Table 120.3-A.

END OF SECTION

SECTION 23 1123
FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.

1.02 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. 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.

PART 2 - PRODUCTS**2.01 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.02 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 4. Corrugated stainless-steel tubing with polymer coating.
 5. Operating-Pressure Rating: 0.5 psig.
 6. End Fittings: Zinc-coated steel.
 7. Threaded Ends: Comply with ASME B1.20.1.
 8. Maximum Length: 72 inches.
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
 2. Nitrile seals.
 3. Hand operated with automatic shutoff when disconnected.
 4. For indoor or outdoor applications.
 5. Adjustable, retractable restraining cable.
- C. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for NPS 2 and smaller.
 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig.
- D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.03 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.04 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated brass.

4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: PE.
 3. Ball: PE.
 4. Stem: Acetal.
 5. Seats and Seals: Nitrile.
 6. Ends: Plain or fusible to match piping.
 7. CWP Rating: 80 psig.
 8. Operating Temperature: Minus 20 to plus 140 deg F.
 9. Operator: Nut or flat head for key operation.
 10. Include plastic valve extension.
 11. Include tamperproof locking feature for valves where indicated on Drawings.
- G. Valve Boxes:
1. Cast-iron, two-section box.
 2. Top section with cover with "GAS" lettering.
 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 4. Adjustable cast-iron extensions of length required for depth of bury.
 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.05 PRESSURE REGULATORS

- A. General Requirements:
1. Single stage and suitable for natural gas.
 2. Steel jacket and corrosion-resistant components.
 3. Elevation compensator.
 4. End Connections: Threaded for regulators NPS 2 and smaller.
- B. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Maxitrol Company.
 - b. Actaris.
 - c. American Meter Company.
 - d. Eclipse Combustion, Inc.
 - e. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - f. Invensys.
 - g. Richards Industries; Jordan Valve Div.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

2.06 DIELECTRIC UNIONS

- A. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International Ltd.
 - e. Matco-Norca, Inc.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.07 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.01 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

- 3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.02 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.03 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.04 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. 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.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

- B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.06 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.07 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.08 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.09 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be the following:
 - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 3 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Underground, below building, piping shall be one of the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground: PE valves.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 3 and smaller at service meter shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be the following:
 1. Bronze plug valve.

END OF SECTION

SECTION 23 3113 DUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Casing and plenums.
- C. Flexible ductwork.

1.02 RELATED SECTIONS

- A. Section 09 9000 - Paints and Coatings: Weld priming, weather resistant, paint or coating.
- B. Section 23 3300 - Air Duct Accessories.
- C. Section 23 3713 - Diffusers, Registers, and Grilles.
- D. Section 23 0593 - Testing, Adjusting, and Balancing.

1.03 REFERENCES

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2005a.
- B. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- C. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2006.
- D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2004.
- E. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 1985, First Edition.
- F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; 2005.

1.04 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide data for duct materials, duct liner, and duct connections.
- C. Shop Drawings: Indicate duct fittings, such as gages, sizes, welds, and configuration prior to start of work for all systems.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.
- E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. VOC Content: Not more than 250 g/L, excluding water.
 - 3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
 - 4. For Use With Flexible Ducts: UL labeled.
- C. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45-degree lateral wye takeoffs unless otherwise indicated where 90-degree conical tee connections may be used.
- F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.03 DUCT MANUFACTURERS

- A. Metal-Fab, Inc: www.mtlfab.com.
- B. SEMCO Incorporated: www.semcoinc.com.
- C. United McGill Corporation: www.unitedmcgill.com.
- D. Or Approved Equal

2.04 MANUFACTURED METAL DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Flat Oval Ducts: Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gages heavier metal than duct.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- C. Install and seal metal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with enough space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
- I. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- J. At exterior wall louvers, seal duct to louver frame.

3.02 SCHEDULES

- A. Ductwork Material:
 - 1. General Exhaust & Outside Air: Galvanized Steel.
- B. Ductwork Pressure Class:
 - 1. General Exhaust & Outside Air: 1 inch.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Backdraft dampers.
- B. Duct test holes.
- C. Volume control dampers.
- D. Combination Fire Smoke Dampers
- E. Flange Connectors
- F. Turning Vanes
- G. Flexible Connectors
- H. Flexible Ducts

1.02 RELATED SECTIONS

- A. Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 3113 - Ducts.

1.03 REFERENCES

- A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- B. NFPA 92A - Standard on Smoke-Control Systems; National Fire Protection Association; 2006.
- C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.

1.05 PROJECT RECORD DOCUMENTS

- A. Record actual locations of access doors and test holes.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

1.08 EXTRA MATERIALS

- A. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS**2.01 BACKDRAFT DAMPERS**

- A. Manufacturers:
 - 1. Nailor Industries Inc: www.nailor.com.

2. Ruskin Company: www.ruskin.com.
3. Greenheck.
- B. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.02 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.03 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 1. Louvers & Dampers, Inc: www.louvers-dampers.com.
 2. Nailor Industries Inc: www.nailor.com.
 3. Ruskin Company: www.ruskin.com.
 4. Greenheck.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- F. Quadrants:
 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.04 COMBINATION FIRE SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Greenheck Fan Corporation.
 5. McGill AirFlow LLC.
 6. METALAIRE, Inc.
 7. Nailor Industries Inc.
 8. NCA Manufacturing, Inc.
 9. PHL, Inc.
 10. Pottorff; a division of PCI Industries, Inc.

11. Prefco; Perfect Air Control, Inc.
 12. Ruskin Company.
 13. Vent Products Company, Inc.
 14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Fire Rating: 1-1/2 hours.
- D. Smoke Detector: Integral, factory wired for single-point connection.
- E. Frame: Curtain type with blades inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.138-inch-thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165 deg F rated.

2.05 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.06 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. SEMCO Incorporated.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Double wall.

2.07 FLEXIBLE CONNECTORS

- E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- F. Materials: Flame-retardant or noncombustible fabrics.
- G. Coatings and Adhesives: Comply with UL 181, Class 1.
- H. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.08 FLEXIBLE DUCTS

- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flex master U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- J. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- K. Flexible Duct Connectors:
 - 1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3113 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 23 0548.
- F. Provide balancing dampers at points on exhaust systems where branches are taken from larger

ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

NOT FOR BID

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Ceiling exhaust fans.
- B. Utility Set Fans
- C. Centrifugal Roof Ventilators

1.02 RELATED SECTIONS

- A. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 3300 – Air Duct Accessories: Backdraft dampers.
- C. Section 26 2726 – Wiring Devices: Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 1999 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
- C. AMCA (DIR) - Directory of Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; <http://www.amca.org/licenses/search.aspx>.
- D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2005.
- E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.
- F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.
- G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2004.
- H. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; 2004.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Loren Cook Company: www.lorencook.com.
- B. Greenheck: www.greenheck.com.
- C. PennBarry: www.pennbarry.com.
- D. Twin City Fans.
- E. Soler & Palau.

2.02 CEILING EXHAUST FANS

- A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge. Fan wheel shall be directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removeable for service.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch where indicated.
- C. Grille: Aluminum with baked white enamel finish. (Ceiling mounted fans only)
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.03 UTILITY SET FANS

- A. Housing: Fabricated steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
 - 1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- B. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
 - 1. Blade Materials: Steel.
 - 2. Blade Type: Backward inclined.
- C. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.

2.04 CENTRIFUGAL ROOF VENTILATORS

- A. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- B. Belt Drives:
 - 1. Resiliently mounted to housing.
 - 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - 5. Fan and motor isolated from exhaust airstream.
- C. Accessories:
 - 1. Disconnect Switch
 - 2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
 - 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions. Provide mounting hardware.
- B. Install power ventilators level and plumb.
- C. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.
 - 2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.
 - 3. Support suspended units from structure using threaded steel rods and spring hangers. Vibration-control devices are specified in Division 23 section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- D. Provide sheaves required for final air balance.
- E. Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.
- F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Building Wires and Cable."

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.

11. Remove and replace malfunctioning units and retest as specified above.

- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

SECTION 23 3713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Diffusers.
- B. Registers/grilles.

1.02 RELATED SECTIONS

- A. Section 099000 - Paints and Coatings: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCES

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 1999.
- B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2001.
- C. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.
- D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Titus: www.titus-hvac.com.
- B. Krueger: www.krueger-hvac.com.
- C. Shoemaker
- D. Tuttle & Bailey
- E. Metal-Aire.

2.02 PERFORATED PLATE SUPPLY DIFFUSERS "A"

- A. Type: Square, stamped, removable, adjustable modular core diffuser for fully adjustable air pattern control with perforated face.
- B. Frame: Lay-in ceiling mount type, flush with ceiling.
- C. Fabrication: Steel construction with zinc phosphate finish and prime coat.
 - 1. Accessories: concealed hinges, square to round adaptors, ceiling mount.

2.03 PERFORATED PLATE RETURN REGISTERS "B"

- A. Type: Square, stamped, same construction and appearance as supply air perforated diffusers.
- B. Frame: Lay-in ceiling mount type, flush with ceiling.
- C. Fabrication: Steel construction with zinc phosphate finish and prime coat.

2.04 PLATE SUPPLY DIFFUSERS "C"

- A. Type: Square, stamped, removable, adjustable modular core diffuser for fully adjustable air pattern control.
- B. Frame: Surface mount type, flush with ceiling.
- C. Fabrication: Steel construction with zinc phosphate finish and prime coat.
 - 1. Accessories: Opposed blade damper with damper adjustment from diffuser face (where indicated), concealed hinges, square to round adaptors, ceiling mount.

2.05 FIXED FACE BAR TYPE EXHAUST/RETURN REGISTERS "D"

- A. Type: Streamlined, 1/8 by 3/4 inch blades on 3/4 inch centers.
- B. Frame: 1-1/4" wide, surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Steel construction with zinc phosphate finish and prime coat.
 - 1. Accessories: Opposed blade damper with damper adjustable from diffuser face.

2.06 DOUBLE-DEFLECTION FACE BAR TYPE SUPPLY DIFFUSERS "E"

- A. Type: Streamlined, 1/8 by 3/4 inch front blades on 3/4 inch centers, parallel to long dimension.
- B. Rear blades parallel to short dimension.
- C. Frame: 1-1/4" wide, surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel construction with zinc phosphate finish and prime coat.
 - 1. Accessories: Opposed blade damper with damper adjustable from diffuser face.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with airtight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9000.

END OF SECTION

SECTION 23 8126
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section includes variable refrigerant flow split-system air-conditioning and heat-pump units for a heat recovery system consisting of separate evaporator-fan and compressor-condenser components.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. 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.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.04 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: Five year(s) from date of Substantial Completion.
 - c. For Labor: Five year(s) from date of Substantial Completion.

1.05 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems
 2. LG Electronics U.S.A.
 3. Daikin AC, Inc.
 4. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
 5. Trane; a business of American Standard companies.

2.02 INDOOR UNITS 5 TONS OR LESS

- A. Wall and Ceiling-Mounted, Evaporator-Fan Components:
1. Cabinet: Galvanized Steel
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
 3. Fan: Direct drive, centrifugal.
 4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 - f. Mount unit-mounted disconnect switches on exterior of unit.
 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
 6. Condensate Drain Pans:
 - a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
 - 2) Depth: A minimum of 1 inch (25 mm) deep.
 - b. Single-wall, polymer sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 7. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.

- 3) Filter-Holding Frames: Filters shall be removable from one side or lifted out from access plenum.
- b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch (25 mm).
 - 3) MERV according to ASHRAE 52.2: 8.
 - 4) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - 5) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.03 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. The cabinet and condenser coils shall have a corrosion protective coating capable of surpassing standards set forth by the ASTM B117 standard and the simulated corrosive atmospheric breakdown (SCAB) test. The corrosion coating shall further be capable of withstanding a 5000-hr salt spray test. The corrosion protective coating shall be provided by Blygold, Thermoguard, Adsil, or approved equivalent. Copper-nickel alloy 706 or approved equivalent shall be used during conditions with extreme exposure to heavy salt-air concentrations.
3. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Inverter-driven compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240. Provide electronically controlled expansion valve.
4. Fan: Weather resistant plastic or aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Mounting Base: Polyethylene.

2.04 ACCESSORIES

A. Controls:

1. Heat recovery (HR) unit shall have factory installed unit mounted control boards and integral microprocessor to communicate with other devices in the VRF system.
2. HR unit shall communicate with the air source unit via the air source/indoor unit 2-conductor shielded communications cable terminated using a daisy chain configuration.
3. The VRF manufacturer shall provide published documentation that specifically allows the installation of field provided isolation valves on all pipes connected to the Heat Recovery unit to allow the servicing of the HR units refrigerant circuit or the replacement of HR unit without evacuating the balance of the piping system.

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- E. Drain Hose: For condensate.
- F. Additional Monitoring:
 - 1. Monitor constant and variable motor loads.
 - 2. Monitor cooling load.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to structure with removable fasteners.
- D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
- E. Install seismic restraints.
- F. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

END OF SECTION 23 8126

SECTION 26 0126
ELECTRICAL ACCEPTANCE AND START- UP TESTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acceptance and start-up testing requirements for electrical power distribution equipment and systems. Contractor shall retain and pay for the services of a recognized independent testing firm for the purpose of performing inspections and tests as herein specified.
1. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
 2. It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturers tolerances and is installed in accordance with design specifications.
 3. Tile tests and inspections shall determine suitability for start-up and energization.
 4. The following equipment shall be tested and calibrated:
 - a. Protective relays, instruments, and metering systems.
 - b. Grounding system and ground fault protection systems.
 - c. Low voltage cables and feeders.

1.02 CODES, STANDARDS, AND REFERENCES

- A. All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein.
1. National Electrical Manufacturers Association – NEMA
 2. American Society for Testing and Materials – ASTM
 3. Institute of Electrical and Electronic Engineers – IEEE
 4. InterNational Electrical Testing Association – NETA
 - a. Acceptance Testing Specifications – ATS latest edition.
 5. American National Standards Institute – ANSI 02
 - a. National Electrical Safety Code.
 6. State and Local Codes and Ordinances.
 7. Insulated Cable Engineers Association – ICEA
 8. Occupational Safety and Health Administration – OSHA
 9. Section 01400 Building System Commissioning Program.
 10. National Fire Protection Association – NFPA
 - a. ANSI/NFPA 70: National Electrical
 - b. ANSI/NFPA 78: Lightning Protection Code
 - c. ANSI/NFPA 101: Life Safety Code
- B. All inspections and tests shall utilize the following references.
1. Project design specifications.
 2. Project design drawings.
 3. Manufacturers instruction manuals applicable to each particular apparatus.
 4. Project list of equipment to be inspected and tested.

1.03 QUALIFICATIONS OF TESTING FIRM

- A. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems with at least five (5) years of documented experience.
- C. The testing firm shall meet OSHA criteria for accreditation of testing laboratories, or be a full member company of the InterNational Electrical Testing Association (NETA) or qualified to be a member of NETA.
- D. The lead on-site, technical person shall be currently certified by the InterNational Electrical Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.
- E. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.
- F. The testing firm shall submit proof of the above qualifications with bid documents when requested.
- G. The terms used herewithin, such as test agency, test contractor, testing laboratory, or contractor Test Company, shall be construed to mean the testing firm.

1.04 SUBMITTAL

- A. Provide submittal per Contract General Conditions, Division 1, and Section 26 05 10.
- B. Qualification of testing firm.
- C. Certified test reports.
- D. Two copies of blank forms for checklists, test reports, and other related forms for Engineer's review and approval.

1.05 GENERAL REQUIREMENTS

- A. Routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment shall be performed, prior to and in addition to acceptance tests specified herein.
- B. The testing firm shall notify the Engineer within 3 working days prior to commencement of any testing.
- C. Any system, material, or workmanship which is found defective on the basis of Acceptance Tests shall be reported to the Engineer with corrective recommendations.
- D. The testing firm shall maintain a written-record of all tests and, upon completion of project shall assemble and certify a final test report.
- E. Test report.

1.06 SAFETY AND PRECAUTIONS

- A. Safety practices shall include, but are not limited to the following requirements:
 - 1. Occupational Safety and Health Act.
 - 2. Accident Prevention Manual for Industrial Operations, National Safety Council.
 - 3. Applicable state and local safety operating procedures.
 - 4. Owners safety practices.
 - 5. National Fire Protection Association – NFPA 70A.
 - 6. American National Standards for Personnel Protection.
- B. All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.
- C. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

D. Test Report:

1. The test report shall include the following:
 - a. Summary of project.
 - b. Listing of equipment tested.
 - c. Test results.
 - d. Recommendations.
2. Furnish copies of the complete report to the Engineer as directed in the contract documents.

1.07 INSPECTION AND TEST PROCEDURES

- A. Contractor to provide the testing firm with a copy of related contract documents such as drawings, specifications, engineer reviewed submittals, coordination study report including all relay settings and other necessary information.
- B. Contractor to supply a suitable source of power to each site per testing firm requirements.
- C. Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- D. Testing firm to review and evaluate all received documents and notify Contractor and Engineer of any shortcoming documents and/or other requirements immediately.
- E. Testing firm to provide and comply with the following:
 1. Acceptance test procedures for each individual equipment listed on Part 1 of this section for Engineer review and approval prior to any test and after thorough evaluation of the system. Testing shall conform to the international Electrical Testing Association (NETA) specifications and standards for electrical power distribution equipment and systems and manufacturer's instructions.
 2. Refer to each individual specification section for testing requirements and comply.
 3. Inspect installed equipment and report any discrepancy and deficiency with contract documents and governing codes prior to testing.

1.08 SYSTEM FUNCTION TEST

- A. Perform system function test upon completion of equipment test as defined in this section. It is the purpose of system function tests to prove the proper interaction of all sensing, processing, and action devices.
- B. Implementation.
 1. Develop test parameters for the purpose of evaluation performance of all integral components and their functioning as a complete unit within design requirements.
 2. Test all interlocking devices.
 3. Record the operation of alarms and indicating devices.

1.09 DEFICIENCIES

- A. All deficiencies reported by testing firm to be corrected by Contractor and Acceptance Test to be re-done accordingly.

END OF SECTION

SECTION 26 0510
GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections.
- B. All Specification Sections under Division 26.

1.02 SUMMARY

- A. This Section includes:
 - 1. Definitions.
 - 2. Excavation.
 - 3. Coordination of work.
 - 4. Cleaning, patching repairing and painting.
 - 5. Guarantees.
 - 6. Field test.

1.03 REFERENCES

- A. American National Standards Institute, Inc. (ANSI) Publications:
 - 1. C2 - National Electrical Safety Code.
- B. California Code of Regulations (CCR) Publications:
 - 1. Title 8, Industrial Relations.
 - 2. Title 19, State Fire Marshal Regulations.
 - 3. Title 24, Part 2, Energy Conservation Standards.
 - 4. Title 24, Part 3, CCR, California Electrical Code.
 - 5. Title 24, Part 9, CCR, California Fire Code.
- C. National Electrical Manufacturers Association (NEMA) Publication: ICS6-93 Enclosures for Industrial Controls and Systems.
- D. National Fire Protection Association (NFPA) Publications:
 - 1. 70B Recommended Practice for Electrical Equipment Maintenance.
 - 2. NFPA 101 Life Safety Code.
- E. State of California Public Utilities Commission (Cal. P.U.C.) Publications:
 - 1. G.O. 95 Rules for Construction of Underground Electrical Supply and Communications Rules for Overhead Electric Line Construction.
 - 2. G.O. 128 Systems.

1.04 DEFINITIONS

- A. The following definitions apply to terms used in these standards.
 - 1. The words "work" or "electrical work" include products, labor, equipment, tools, appliances, transportation, and all related items directly or indirectly required to complete the specified and indicated electrical installation.
 - 2. The word "concealed" shall mean that the installation will not be visible when all permanent or removable elements of the construction are in place. The word "exposed" shall mean that the installation is visible when all permanent or removable elements of the construction are in place.
 - 3. The word "code" shall mean any and all regulations and requirements of regulatory bodies, public and private, having jurisdiction over the work involved.

4. The word "product" used in Division 26 means all material, equipment, machinery, and/or appliances directly or indirectly required to complete the specified and/or indicated electrical work.
5. The words "standard product" shall mean a manufactured product, illustrated and/or described in catalogs or brochures, that is in general distribution prior to the date of issue of construction documents. Products will generally be identified by means of a specific catalog number and manufacturer's name.
6. "Provide" means furnish, install, connect and test unless otherwise noted.
7. The words "conduit" and "duct" are used interchangeably and have the same meaning.
8. "UFER" Ground: See Section 26 0526, "Grounding and Bonding".

1.05 DRAWINGS AND SPECIFICATIONS

- A. Electrical drawings are diagrammatic but shall be followed as closely as actual construction and work of the other sections shall permit. Size and location of equipment is drawn to scale wherever possible.
- B. Drawings and specifications are for the assistance and guidance of the Contractor. Exact locations, distances, and levels will be governed by the building. The Contractor shall make use of data in all the contract documents and verify information at the building site.
- C. In any case where there appears to be a conflict or ambiguity between that which is shown on the electrical drawings or in the electrical specifications and any other part of the Contract Documents, it shall be understood that the greater quantity or the better quality shall be used unless a written decision by the owner's representative has been obtained.
- D. Drawings and specifications are intended to complement each other. Where a conflict or ambiguity exists between the requirements of the drawings and the specifications, request clarification. Do not proceed with work without direction.
- E. The Architect shall interpret the drawings and the specifications. The interpretation by the Architect as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusion.
- F. In the case of conflicts or ambiguities not clarified prior to the bidding deadline, use the most costly alternative (better quality, greater quantity, and larger size) in preparing the bid. A clarification will be issued to the successful bidder as soon as feasible after the award and, if appropriate, a deductive change order will be issued. No additional cost shall be approved for failure to use the most costly alternative in the bid.
- G. Where items are specified in the singular, this division shall provide the quantity as shown on drawings plus any spares or extras indicated on the drawings or in the specifications.
- H. **RECORD DRAWINGS**

1. On one (1) set of contract drawings, kept at the site during construction, mark all work that is installed differently from that shown on plans, including revised circuitry, material or equipment. Sufficient dimensions shall be provided to locate all materials installed beneath and outside the building including, but not limited to, underground conduits, cabling, ground rods, and stubouts.
2. All changes or revisions to the contract drawings including, but not limited to, those indicated by amendment, change order, field order, written response to RFI/RFC or other contractual means shall be kept current as the work progresses and shall be incorporated onto the final record drawings.
3. Accurately locate and dimension all underground and embedded conduit runs on the record drawings.
4. The marked drawings shall be kept current as the work progresses and shall be available for inspection upon request. At the close of construction, prepare a set of accurate reproducible record drawings and turn them over to the Architect. The correct and

completed record drawings are a prerequisite to final contract payment.

- a. As part of the reproducible record drawings, the Contractor shall produce full size reproducible drawings with the: Final panelboard schedules as modified during construction and final light fixture schedule as modified during construction.
 - b. These drawings shall be on Architectural base sheets and numerically sequenced to follow the last "E" sheet.
5. As part of the reproducible record drawings, the Contractor shall produce full size reproducible drawings for all signal systems which shall include exact "As-Built" device locations, "As-Built" interconnection drawings, and "As-Built" riser diagrams, and provide one set in the panel board, motor control center, or main distribution panel.

1.06 EXAMINATION OF SITE

- A. Examination of the building site shall be made by the Contractor. The Contractor shall compare it with the drawings and specification and satisfy himself as to the conditions under which work is to be performed. The Contractor shall, at such time, ascertain and check the locations of existing structures or equipment which may affect his work.

1.07 EXCAVATION

- A. Prior to starting excavation or trenching, the Contractor shall perform an underground Site Survey utilizing an electronic locator to verify the exact location of all existing underground utility piping, conduits and conductors. The Contractor shall submit for approval a site survey report to the Architect within five (5) working days after the survey is performed. The Site Survey Report shall show the horizontal location for existing utilities and identify any possible conflicts between the new work and existing utilities.

1.08 PERMITS, FEES AND INSPECTIONS

- A. Permits, fees, and inspections shall be arranged for and paid by the Contractor.
- B. The Contractor shall present to the Architect, properly signed certificates of the final inspection before work will be accepted.

1.09 ELECTRO-MECHANICAL REQUIREMENTS

- A. The power wiring, safety switches, combination controllers (indicated on electrical plans), circuit breakers, and motor control equipment forming a part of motor-control centers or switchgear assemblies, and the electrical connection of the mechanical equipment to the electrical power source shall be included under Division 26.
- B. The electrical components of mechanical equipment including, but not limited to, motors, motor-starters, control or pushbutton stations, float-pressure switches, solenoid valves, thermostats, junction boxes, and other devices functioning to control mechanical equipment shall be provided under Division 23. Interconnecting wiring for packaged equipment shall be provided as an integral part of the equipment.
- C. Control Wiring: Installation of line and low voltage conduit, wiring and junction/outlet boxes not shown on the electrical drawings but required for controlling or monitoring mechanical equipment systems shall be furnished and installed under Division 23. Installation of these shall comply with the requirements of Division 26.
- D. If substitution of controls or mechanical equipment other than that specified requires any changes in the electrical work from that shown on the plans or specified in Division 26, any additional cost of the equipment or electrical work shall be the responsibility of Division 23.

1.10 REQUIREMENTS OF REGULATORY AGENCIES

- A. Perform work in accordance with all pertaining status, ordinances, laws, rules, codes, regulations, standards local codes and the lawful orders of all public authorities having jurisdiction, the same as if repeated in full herein without limitations.

1.11 SUBMITTALS

- A. Submittal requirements for Division 26 shall be in accordance with Division 1 except as

modified herein. All time requirements shall be based on the notice to proceed date of the General Contract. All materials and equipment furnished under Division 26 shall; be submitted to the Architect for approval. Such approval shall be in writing from the Architect including that which is exactly as specified. Any materials or equipment installed without written approval shall be subject to immediate removal. Approval of material or equipment shall in no way obviate compliance with the contract documents.

- B. Submittals shall be packaged separately for each system or major piece of equipment and reviewed by the Contractor for verification of compliance with the contract documents prior to submitting to the Architect. Separate, bound submittals shall be provided for each specification section to the Architect. All interface between specification sections shall be indicated in each submittal.
- C. All materials and equipment shall be new and shall bear the inspection label of the Underwriters Laboratories (UL) where applicable. Materials and equipment shall be the latest standard product and shall be of the grade indicated by the trade names given.
- D. The work shown on the contract drawings is engineered and designed to accommodate the equipment described hereinafter in these specifications.
- E. Equipment submittal shall include manufacturer's name, model, type, number, finish, size and capacity of the equipment at the given conditions. This information shall be provided in bound submittals, each containing an index and all submittals. Provide seven (7) copies of each submittal. The title shall provide the project name, system identity, the specification number, and the Contractor's name and address. This submittal shall be in addition to the shop drawings hereinafter specified. Partial submittals of material submitted from time to time are not acceptable and may be returned without review.
- F. Submittals shall be reviewed by the Architect for compliance with the contract documents. Submittals found to be incomplete or not in compliance with the contract documents shall be returned for re-submittal. The Architect shall review the original submittal and one (1) re-submittal per section (if required). The Contractor shall reimburse the Architect for all subsequent submittal review.
- G. Shop drawings for service entrance equipment shall be submitted to and approved by the serving utility company metering shop prior to submittal to the Architect and Plan Department.
- H. Equipment Layout Drawings: "Equipment Layout Drawings" shall be provided for each equipment room, yard or area containing equipment items furnished under Division 26. Layout drawings shall consist of a plan view of the room or area (to a 1/4 inch = 1 foot – 0 inch minimum scale) showing projected outlines of all equipment, complete with dotted lines indicating all required clearances, including all clearances needed for removal or service. Location of all conduit and pull boxes shall be indicated. Drawings shall indicate any and all conflicts with other trades.
- I. All work, materials and equipment shall conform to the following standards:
 - 1. Basic Electrical Regulations, Title 24, State Building Standards, California Code of Regulations
 - 2. National Electrical Code
 - 3. Institute of Electrical and Electronic Engineers (IEEE)
 - 4. County and City Electrical Codes
 - 5. American National Standards Institute (ANSI)
 - 6. American Society for Testing and Materials Standard Tests (ASTM)
 - 7. Uniform Building Code (UBC)
 - 8. State Industrial Accident Commission (IAC)
 - 9. Insulated Power Cable Engineers Association (ICEA)
 - 10. National Electric Manufacturers Association (NEMA)

11. National Fire Protection Association (NFPA)
 12. Occupational Safety and Health Act (OSHA)
 13. Underwriters' Laboratories, Inc. (UL)
 14. American Disabilities Act (ADA)
 15. National Electrical Contractors Association Standards for Construction (NECA)
 16. California State and Local Fire Marshal
- J. **Certified Test Reports:** Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- K. **Factory Tests:** Factory Tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this contract.
- L. **Operation and Maintenance Manual:** Furnish an operation and maintenance manual covering the stipulated electrical systems and equipment. Seven copies of the manual, bound in the hardback binders or approved equivalent, shall be provided to the Owner's Representative. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The manual shall be complete in all respects for all equipment, controls, accessories, and appurtenances stipulated. All wiring diagrams shall specifically cover the installed system indicating zones, spare zones and spare capacity, wiring, and components added to the system. Typical drawings will not be accepted.
- M. **Special Submissions:**
1. Test reports for the following:
 - a. Ground fault devices.
 - b. Megger Readings: Ground system, motors, feeders, switchboards, motor control centers and switchgear.
 - c. Voltage Readings: Distribution, service, motors, and transformers.
 - d. Fire Alarm System.
 - e. Power system testing by independent electrical testing laboratory.
 2. A system short circuit on the normal and emergency systems based on available fault symmetrical current as indicated on drawings at high voltage service and emergency generator, calculated by the per unit method or in accordance with the latest Institute Electrical and Electronics Engineers, Inc. (IEEE) recommendations. Reports shall be submitted in copies bound with a stiff cover and shall indicate calculated fault values and equipment ampere interrupting capacities (AIC) for each equipment including downstream panelboards, elevator controllers, dimmer banks, motor control centers, package equipment specified under Division 15, and individual feeder loads. AIC ratings shall be a minimum of 110% of calculated fault values. Reports shall include actual lengths and materials for each feeder per installing Contractor. It shall also include a tabular comparison of equipment withstand and AIC ratings, and calculated fault current at each equipment.

1.12 INCOMING SERVICE

- A. Every effort has been made to determine as accurately as possible the requirements of the electrical and communication services. However, before submitting his bid, the Contractor shall verify the locations shown on the plans and shall include sufficient funds for materials and labor for extensions of lines to service locations which are acceptable to the Owner, etc. In addition, all costs levied by the Owner or any other work which is required for electrical, signal and telephone service to the project must be included, at no additional cost to the Owner.
- B. Before any work is started on these facilities, verify all electrical, civil, architectural, and

structural, dimensional and other requirements related to these facilities with the Owner, and examine the site, and its conditions and include for them in bid. No exception to this shall be permitted, and there shall be no cost to Owner should Contractor not take into account the existing site conditions.

- C. Should any major changes to the work indicated be necessary to comply with the service requirements, notify the Architect at once and cease all work affected until approval for required modifications has been obtained from the Architect.
- D. Within five days after award of Contract, notify Owner that the project is under construction and furnish them the dates on which the various services will be required. Coordinate with adequate notice, outages required for incoming services to the project.

1.13 SUBSTITUTIONS

- A. Equipment submitted for substitution must fit the space conditions shown on the drawings, leaving adequate room for maintenance around all equipment. A minimum of 48 inches (or more if required by Code) must be maintained clear in front of all electrical panels, starters, gutters or other electrical apparatus. Submit drawings showing the layout, size, and exact method of interconnection of conduit, wiring and controls, which shall conform to the manufacturer's recommendations and these specifications. The scale of these drawings shall be the scale of the contract drawings. The Contractor shall bear the excess costs, by any and all crafts, for fitting the equipment into the space and the system designated. Where additional labor or material is required to permit equipment submitted for substitution to function in an approved manner, this shall be furnished and installed by the Contractor without additional cost to the Owner.
- B. No substitutions will be allowed for materials or equipment if three (3) or more manufacturers are indicated. No substitutions will be allowed if not submitted within 30 days after notice to proceed.
- C. An item submitted for substitution does not constitute an "equal" unless approval by the Architect has been given in writing.
- D. Equipment submitted for substitution shall be approved in writing by the Architect and shall be accompanied by the following:
 - 1. A sample of each item submitted for substitution shall accompany the submittal if requested by the Architect.
 - 2. A unit price quotation shall be provided with each item intended for substitution. This quote shall include a unit price for the specified item and a unit price for the intended substitute item. The Contractor shall also provide a total (per item) of the differential payback to the Owner should the intended substitute item be approved as equivalent to that which is specified.
 - 3. The Contractor shall reimburse the Owner for the additional services required by the Architect to review and process substitutions.
- E. Substitutions shall be approved in writing by the Architect. The determination of the Architect shall be final.

1.14 WARRANTY

- A. Warranty requirements for Division 26 shall be in accordance with Division 1 except as modified herein.
- B. All materials and equipment provided shall be warranted for a minimum period of one (1)-year from the official date of completion. In addition, provide two (2)-year extended warranty, for a total of three (3)-years, for the following items:
 - 1. Distribution Switchboards.
 - 2. Disconnect Switches.
 - 3. Panelboards.
 - 4. Circuit Breakers.

- C. The Contractor shall provide all labor and materials required to correct problems which develop during the warranty period due to defective materials or faulty workmanship. The labor and materials to do this work shall be provided at no additional cost to the Owner.
- D. Within one (1)-month prior to the expiration of the warranty period, the Contractor shall correct any and all defects covered by the warranty. This shall include tightening to original specifications of all bolted connections.
- E. Warranty certificates shall be made out to Owner and shall be delivered to the Architect at the completion of the installation.
- F. All equipment shall be guaranteed to be supported in such a way as to be free from objectionable vibration and noise.
- G. Additional warranty requirement shall be as indicated in the following sections of Division 16.

1.15 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall furnish operation and maintenance manuals for each electrical system and for each piece of equipment. The complete manual, bound in hardback binders, or an approved equivalent, shall be provided to the Architect. Provide Seven (7) copies of each manual. One (1) manual shall be furnished prior to the time that system or equipment tests are performed, and the remaining manuals shall be furnished one (1) week before the final job visit is made. The following identification shall be inscribed on the cover; the words "OPERATION AND MAINTENANCE MANUAL", the name and location of the building, the name of the Contractor, and the contract number.
- B. The manual shall include the names, address, and the telephone numbers of each Subcontractor installing equipment and systems, and of the local representatives for each item of equipment and each system. The manual shall have a table of contents and be assembled to conform to the table of contents with tab sheets placed before instructions covering each subject. The instruction sheet shall be legible with large sheets of drawings folded in. The Manual shall include, but not limited to, the following:
 - 1. System layout showing components.
 - 2. Devices and controls.
 - 3. Wiring and control diagrams showing operation and control of each component.
 - 4. Sequence of operation describing start-up, operation, and shutdown.
 - 5. Functional description of the principal system components.
 - 6. Installation instructions.
 - 7. Maintenance and overhaul instructions.
 - 8. Lubrication schedule including type, grade, temperature, range, and frequency.
 - 9. Safety precautions, diagrams and illustrations.
 - 10. Test procedures.
 - 11. Performance data.
 - 12. Parts list.
- C. The parts list for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonably convenient to the building sit. The manual shall be complete in all respects for all equipment, controls, and accessories provided.

1.16 COORDINATION OF ALL WORK

- A. Job Visits by the Architect:
 - 1. Periodic visits to the job by the Architect are for the express purpose of verifying compliance with the contract documents.
 - 2. Such visits shall not be construed as construction supervision. Neither shall such visits be construed as making the Architect responsible for providing a safe place for the performance of the work by the Contractor or the Contractor's employees or the safety of

the supplies of the Contractor or his Subcontractors.

B. Temporary Electrical Service:

1. The Contractor shall provide labor and materials required for the installation and maintenance of temporary lighting and required power sources for the Contractor's equipment inside the building or construction site and for pedestrian walkways during the period of construction.
2. The building or construction site shall be sufficiently illuminated so that construction work can be safely performed. Special attention shall be given to adequately lighting stairs, ladders, pedestrian walkways, floor openings, etc. Walkway lights shall be controlled by a switch within the building or construction site.
3. Power shall be on and all lighting shall be in operation before painting work commences.

C. Posted Operating Instructions:

1. Operating instructions shall be provided by the Contractor at the conclusion of the project for each system and each principal piece of equipment for the use of operating and maintenance personnel. The operating instructions shall include wiring and control diagrams showing the entire system, including, but not limited to, equipment, devices, and control sequences. All operating instruction shall be approved by the Architect.
2. Operating instructions shall be typewritten or engraved and shall be framed under glass or in approved laminated plastic and posted adjacent to each principal piece of equipment and shall include such instructions as start up, proper adjustment, operation, lubrication, shutdown, safety-precautions, procedure in the event of equipment failure, and any other necessary items of instructions as recommended by the manufacturer of unit.
3. Operating instructions exposed to the weather shall be made of weather-resisting materials or shall be suitably enclosed to be weather protected. Operating instructions shall not face when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.17 TRAINING

- A. User staff and maintenance personnel shall be thoroughly trained (minimum four (4)-hours) in the use of each system or major piece of equipment installed. This training shall be provided a part of the Contractors bid to supply the system or equipment. Additional training requirements, shall be as specified in the subsequent sections of Division 16.

1.18 DELIVERY AND STORAGE

- A. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored, and protected in accordance with the manufacturer's recommendations and as approved by the Architect. Electrical conduit shall be stored to provide protection from the weather and accidental damage. Plastic conduit shall be stored on even supports and in locations not subject to direct sunrays or excessive heat. Cables shall be sealed, stored, and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather. Damaged or defective items shall be replaced with new items a no cost to the Owner. The Architect shall determine if a damaged or defective item is to be replaced with a new item. The decisions by the Architect in these matters shall be final.

END OF SECTION

SECTION 26 0519
BUILDING WIRES AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire and cable for 600 volts and less.
- B. Wiring connectors and connections.

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation.
- B. Section 02316 - Fill and Backfill: Bedding and backfilling.
- C. Section 02317 - Trenching for Site Utilities: Excavating, bedding, and backfilling.
- D. Section 26 05 53 – Identification for Electrical Systems.

1.03 REFERENCES

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for each cable assembly type.
- C. Test Reports: Indicate procedures and values obtained.
- D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.
- F. Project Record Documents: Record actual locations of components and circuits.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

- A. Concealed Dry Interior Locations: Use only building wire in raceway.
- B. Exposed Dry Interior Locations: Use only building wire in raceway.
- C. Above Accessible Ceilings: Use only building wire in raceway.
- D. Wet or Damp Interior Locations: Use only building wire in raceway.
- E. Exterior Locations: Use only building wire in raceway, direct burial cable, or service-entrance cable.
- F. Underground Installations: Use only building wire in raceway, direct burial cable, or service-entrance cable.
- G. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

- H. Use stranded conductors for control circuits.
- I. Use conductor not smaller than 12 AWG for power and lighting circuits.
- J. Use conductor not smaller than 16 AWG for control circuits.
- K. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).
- L. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (60 m).
- M. Conductor sizes are based on copper unless indicated as aluminum or "AL".
- N. If aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop.

2.02 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
 - 1. For Sizes Smaller Than 4 AWG: Copper.
 - 2. For Sizes 4 AWG and Larger: Copper or Aluminum.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type THHN/THWN or Type XHHW.
 - 1. For Feeders and Branch Circuits Smaller Than 4 AWG: Type THHN/THWN or XHHW.
 - 2. For Feeders and Branch Circuits Larger Than 4 AWG and larger: Type TW.
- E. Insulation: Thermoplastic material rated 75 degrees C.

2.03 SERVICE ENTRANCE CABLE

- A. Description: NFPA 70, Type USE.
- B. Conductor: Copper.
 - 1. For Sizes Smaller Than 4 AWG: Copper.
 - 2. For Sizes 4 AWG and Larger: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: Type XHHW.

2.04 WIRING CONNECTORS

- A. Factory fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Furnish products listed and classified by testing firm acceptable to the authority having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.
- D. Verify that field measurements are as indicated.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

- A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA
- B. Route wire and cable as required to meet project conditions.
 - 1. Wire and cable routing indicated is approximate unless dimensioned.
 - 2. Where wire and cable destination are indicated and routing is not shown, determine exact routing and lengths required.

3. Include wire and cable of lengths required to install connected devices within 10 ft (3000 mm) of location shown.
- C. Use wiring methods indicated.
- D. Pull all conductors into raceway at same time.
- E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- F. Protect exposed cable from damage.
- G. Support cables above accessible ceiling, using plastic cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- H. Use suitable cable fittings and connectors.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- J. Clean conductor surfaces before installing lugs and connectors.
- K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- L. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
- M. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- N. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- Q. Trench and backfill for direct burial cable installation as specified in Sections 02315 and 02316. Install warning tape along entire length of direct burial cable, within 4 inches (100 mm) of grade, as specified in Section 26 05 33.
- R. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
 - 1. Existing metal underground water pipe.
 - 2. Metal underground water pipe.
 - 3. Metal frame of the building.
 - 4. Steel water storage tank and supports.
 - 5. Concrete-encased electrode.
 - 6. Ground ring specified in Section 02590.
 - 7. Existing metal underground gas piping system.
 - 8. Metal underground gas piping system.
 - 9. Rod electrodes.
 - 10. Plate electrodes.

1.02 RELATED SECTIONS

- A. Section 02590 - Site Grounding.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03300 - Cast-in-Place Concrete.
- D. Section 13100 - Lightning Protection.

1.03 REFERENCES

- A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide for grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations of components and grounding electrodes.
- F. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Power Systems: www.cooperpower.com.
- B. Framatome Connectors International: www.fciconnect.com.
- C. Lightning Master Corporation: www.lightningmaster.com.

2.02 ELECTRODES

- A. Manufacturers:
 - 1. Cooper Power Systems: www.cooperpower.com.
 - 2. Framatome Connectors International: www.fciconnect.com.
 - 3. Lightning Master Corporation: www.lightningmaster.com.
 - 4. Substitutions: See Section 01600 - Product Requirements.
- B. Rod Electrodes: Copper-clad steel.
 - 1. Diameter: 3/4 inch (19 mm).
 - 2. Length: 10 feet (3000 mm).
- C. Foundation Electrodes: 3/0 AWG.

2.03 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors: Bronze.
- B. Exothermic Connections: Cadweld.
- C. Wire: Stranded copper.
- D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.
- E. Grounding Well:
 - 1. Well Pipe: 8 inch (200 mm) by 24 inch (600 mm) long clay tile or concrete pipe with belled end.
 - 2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- A. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- B. Provide grounding well pipe with cover at rod locations where indicated. Install well pipe top flush with finished grade.
- C. Install 4 AWG bare copper wire in foundation footing.
- D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.
- E. Provide bonding to meet requirements described in Quality Assurance.
- F. Bond together metal siding not attached to grounded structure; bond to ground.
- G. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- H. Install ground grid under access floors. Construct grid of 2 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.
- I. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use 2 AWG bare copper conductor.
- J. Provide isolated grounding conductor for circuits supplying electronic cash registers, personal

computers, and all other electronic equipment.

- K. Provide grounding and bonding in patient care areas to meet requirements of NFPA 99 and NFPA 70.
- L. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- M. Interface with site grounding system installed under Section 02590.
- N. Interface with lightning protection system installed under Section 13100.

3.03 FIELD QUALITY CONTROL

- A. Provide field inspection, testing, and adjusting in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION

**SECTION 26 0529
HANGERS AND SUPPORTS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

1.02 REFERENCES

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog data for fastening systems.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Thomas & Betts Corporation: www.tnb.com.
- B. Threaded Rod Company: www.threadedrod.com.

2.02 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
 - 1. Obtain permission from Architect before using powder-actuated anchors.
 - 2. Concrete Structural Elements: Use precast inserts.
 - 3. Steel Structural Elements: Use beam clamps or steel spring clips.
 - 4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
 - 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
 - 6. Solid Masonry Walls: Use preset inserts.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 2. Do not drill or cut structural members.
 3. Obtain permission from Architect before drilling or cutting structural members.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 0533
RACEWAYS, FITTINGS AND BOXES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Conduit, fittings and conduit bodies.

1.02 RELATED SECTIONS

- A. Section 02582 - Underground Electrical Ducts and Manholes.
- B. Section 07840 - Firestopping.
- C. Section 26 05 26 - Grounding and Bonding.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCES

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association; 2013.
- I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2013.
- J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.
- C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches (51 mm).

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS**2.01 CONDUIT REQUIREMENTS**

- A. Conduit Size: Comply with NFPA 70.
 - 1. Minimum Size: 1/2 inch (13 mm) unless otherwise specified.
- B. Underground Installations:
 - 1. More than Five Feet (1.5 Meters) from Foundation Wall: Use thickwall non-metallic conduit.
 - 2. Within Five Feet (1.5 Meters) from Foundation Wall: Use thickwall nonmetallic conduit.
 - 3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, thickwall non-metallic conduit, or thinwall non-metallic conduit.
 - 4. Minimum Size: 3/4 inch (19 mm).
- C. Outdoor Locations Above Grade: Use intermediate metal conduit.
- D. In Slab Above Grade:
 - 1. Use thickwall nonmetallic conduit.
 - 2. Maximum Size Conduit in Slab: 3/4 inch (19 mm); 1/2 inch (13 mm) for conduits crossing each other.
- E. Wet and Damp Locations: Use thickwall nonmetallic conduit.
- F. Dry Locations:
 - 1. Concealed: Use electrical metallic tubing.
 - 2. Exposed: Use intermediate metal conduit.

2.02 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedtube.com.
 - 2. Beck Manufacturing, Inc: www.beckmfg.com.
 - 3. Wheatland Tube Company: www.wheatland.com.
 - 4. Substitutions: See Product Requirements Spec section.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Rigid Aluminum Conduit: ANSI C80.5.
- D. Intermediate Metal Conduit (IMC): Rigid steel.
- E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.03 PVC COATED METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedtube.com.
 - 2. Thomas & Betts Corporation: www.tnb.com.
 - 3. Robroy Industries: www.robroy.com.
- B. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil (0.1 mm) thick.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com.
 - 2. Electri-Flex Company: www.electriflex.com.
 - 3. International Metal Hose: www.metalhose.com.

- B. Description: Interlocked steel construction.
- C. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com.
 - 2. Electri-Flex Company: www.electriflex.com.
 - 3. International Metal Hose: www.metalhose.com.
- B. Description: Interlocked steel construction with PVC jacket.
- C. Fittings: NEMA FB 1.

2.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedtube.com.
 - 2. Beck Manufacturing, Inc: www.beckmfg.com.
 - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.07 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com.
 - 2. Electri-Flex Company: www.electriflex.com.
 - 3. International Metal Hose: www.metalhose.com.
 - 4. Substitutions: See Product Requirements Spec section.
- B. Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.08 NONMETALLIC TUBING

- A. Manufacturers:
 - 1. Beck Manufacturing, Inc: www.beckmfg.com.
 - 2. Cantex, Inc: www.cantexinc.com.
 - 3. Lamson & Sessions (Carlon): www.carlon.com.
 - 4. Substitutions See Product Requirements Spec section.
- B. Description: NEMA TC 2.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.09 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers:
 - 1. Appleton Electric: www.appletonelec.com.
 - 2. Arc-Co/Division of Arcade Technology: www.arc-co.com.
 - 3. Unity Manufacturing: www.unitymfg.com.

2.10 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.

- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, cast fer alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 02726.

2.11 FLOOR BOXES

- A. Floor Boxes: NEMA OS 1, fully adjustable, 1-1/2 inches (38 mm) deep.
- B. Material: Cast metal.
- C. Shape: Octagonal.
- D. Service Fittings: As specified in Section 26 2726.

2.12 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 0533.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside or inside flanged, recessed cover box for flush mounting:
 - 1. Material: Galvanized cast iron or Cast aluminum.
 - 2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "ELECTRIC".
- E. Fiberglass Handholes: Die molded glass fiber hand holes:
 - 1. Cable Entrance: Pre-cut 6 x 6 inch (150 x 150 mm) cable entrance at center bottom of each side.
 - 2. Cover: Glass fiber weatherproof cover with nonskid finish.

2.13 CABINETS AND ENCLOSURES

- A. Manufacturers:
 - 1. Cooper B-Line: www.bline.com.
 - 2. Qube Corporation: www.qubeinc.com.
 - 3. Robroy Industries: www.robroy.com.

2.14 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, Type 1 steel enclosure.
- B. Covers: Continuous hinge, held closed by flush latch operable by key.
- C. Provide interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
- D. Enclosure Finish: Manufacturer's standard enamel.

2.15 CABINETS

- A. Boxes: Galvanized steel.
- B. Backboard: Provide 3/4 inch (19 mm) thick plywood backboard for mounting terminal blocks. Paint matte white.
- C. Fronts: Steel, flush or surface type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard.
- D. Knockouts:

- E. Provide metal barriers to form separate compartments wiring of different systems and voltages.
- F. Provide accessory feet for free-standing equipment.

2.16 TERMINAL BLOCKS

- A. Manufacturers:
 - 1. Allen-Bradley/Rockwell Automation: www.ab.com.
 - 2. Cooper Bussmann: www.bussmann.com.
 - 3. WECO Electrical Connectors Inc: www.weco.ca.
- B. Terminal Blocks: NEMA ICS 4.
- C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- E. Provide ground bus terminal block, with each connector bonded to enclosure.

2.17 ACCESSORIES

- A. Plastic Raceway: Plastic channel with hinged or snap-on cover.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

- A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install steel conduit as specified in NECA 101.
- C. Install nonmetallic conduit in accordance with manufacturer's instructions.
- D. Arrange supports to prevent misalignment during wiring installation.
- E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- F. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- G. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529.
- H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- I. Do not attach conduit to ceiling support wires.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route exposed conduit parallel and perpendicular to walls.
- L. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- M. Route conduit in and under slab from point-to-point.
- N. Do not cross conduits in slab.
- O. Maintain adequate clearance between conduit and piping.
- P. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

- Q. Cut conduit square using saw or pipecutter; de-burr cut ends.
- R. Bring conduit to shoulder of fittings; fasten securely.
- S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- T. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations, and to cast boxes.
- U. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.
- V. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- W. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- X. Provide suitable pull string in each empty conduit except sleeves and nipples.
- Y. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Z. Ground and bond conduit under provisions of Section 26 0526.
- AA. Identify conduit under provisions of Section 26 0553.
- AB. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- AC. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEPA 70.
- AD. Coordinate installation of outlet boxes for equipment connected under Section 26 0534.
- AE. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- AF. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10 feet (3 m) if required to accommodate intended purpose.
- AG. Orient boxes to accommodate wiring devices oriented as specified in Section 26 0534.
- AH. Maintain headroom and present neat mechanical appearance.
- AI. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- AJ. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- AK. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.
- AL. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- AM. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- AN. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- AO. Use flush mounting outlet box in finished areas.
- AP. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- AQ. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.
- AR. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- AS. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- AT. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- AU. Use adjustable steel channel fasteners for hung ceiling outlet box.

- AV. Do not fasten boxes to ceiling support wires.
- AW. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.
- AX. Use gang box where more than one device is mounted together. Do not use sectional box.
- AY. Use gang box with plaster ring for single device outlets.
- AZ. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- BA. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- BB. Set floor boxes level.
- BC. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.
- BD. Clean electrical parts to remove conductive and harmful materials.
- BE. Remove dirt and debris from enclosure.
- BF. Clean finishes and touch up damage.

3.03 ADJUSTING

- A. Adjust floor boxes flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused box openings.

3.04 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.
- C. Clean electrical parts to remove conductive and harmful materials.
- D. Remove dirt and debris from enclosure.
- E. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 0534
OUTLET, PULL AND JUNCTION BOXES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Provisions of Section 26 05 10, "General Electrical Requirements".

1.02 REFERENCES

- A. National Electrical Manufacturers Association.
- B. American Society for Testing and Materials.
- C. National Electrical Code
 - 1. Division 2 Section "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.
 - 2. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 3. Division 26 Section "General Electrical Requirements" for supports, anchors, and identification products.

1.03 SUMMARY

- A. Outlet Boxes.
- B. Pull Boxes.
- C. Junction Boxes.
- D. Floor Boxes.

1.04 WARRANTY:

- A. Warranty shall comply with the provisions of Section 26 05 10, "General Electrical Requirements".

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The size of each outlet or junction box shall be determined by the number and sizes of wires and conduits entering the box but shall be not less than 4-inch square and 2-1/8-inches deep unless otherwise indicated.
- B. Outlet and junction boxes for interior use shall be galvanized or sherardized, one-piece pressed or welded steel, knockout type, except where other types of boxes are indicated or specified.
- C. Outlet and junction boxes for exterior use shall be lug type "Bell" boxes "250L" through "254L", "Crouse-Hinds FS" type, as applicable or equal.
- D. Outlet boxes shall be equipped with plaster rings, inserts and fixture studs as may be required. Knockout seals shall be provided where knockouts are not intact.
- E. Plastic, fiber or composition boxes shall not be permitted.
- F. Telecommunication Outlets: Voice and data wall outlet boxes shall be 4-11/16-inch square by 2-1/8-inch deep metal boxes, with plaster ring.
- G. Outlet boxes for hazardous locations (Class I, Groups A, B, C, and D; and Class II, groups D, F and G) shall be in accordance with U.L. 886.
- H. All exterior pull boxes, plates, fittings, etc., mounted below 10 feet – 0 inch in height shall be fitted with rustproof, tamperproof screws. Provide Owner with two (2) screw drivers (or wrenches) to fit special screws. Screws shall be Spanner, Key Slot, or Rosette.
- I. Boxes in concrete shall be of the type to allow placing of conduit without displacing reinforcing bars and shall be type approved for concrete use. Boxes installed in poured concrete shall be

packed with approved material to prevent concrete entering box. Do not use paper for such packing.

- J. Floor boxes shall be Walker Box Resource RFB or equal, no known equal series with brass plates and brass carpet flanges for carpeted areas.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Outlet boxes shall be securely and independently fastened to the structure and in concealed work shall be supported flush with finished surface of walls or ceiling.
- B. Bar hangers fitted with fixture studs shall be used to support and outlet boxes in stud partitions and in furred or plastered ceilings.
- C. Fasteners shall be machine screws, nut and lock washers in metal, wood screws, in wood, or expansion shields or inserts in masonry or concrete. Wooden inserts will not be acceptable.
- D. Label outside of box to identify panel and circuit numbers. Use indelible markers, non-erasing type, for boxes above ceilings or in concealed locations.
- E. Fire alarm boxes shall be painted red.

END OF SECTION

SECTION 26 0553
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Field-painted identification of conduit.

1.02 RELATED SECTIONS

- A. Section 09900 - Paints and Coatings.

1.03 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.06 EXTRA MATERIALS

- A. See Section 01600 - Product Requirements for additional requirements.

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

- A. Nameplates (PV and BESS): Engraved three-layer laminated plastic, white letters on red background.
Nameplates (All other electrical equipment): Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Communication cabinets.
- C. Letter Size:
 - 1. For PV and BESS equipment and plaques (per details on sheets)
 - 2. Use 1/8 inch (3 mm) letters for identifying individual equipment and loads.
 - 3. Use 1/4 inch (6 mm) letters for identifying grouped equipment and loads.
- D. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches and receptacles, and control device stations.

2.02 WIRE MARKERS

- A. Description: Cloth, tape, split sleeve, or tubing type wire markers.

- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and at each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.03 CONDUIT MARKERS

- A. Location: Furnish markers for each conduit longer than 6 feet (2 m).
- B. Spacing: 20 feet (6 m) on center.
- C. Color:
 - 1. 480 Volt System: Orange.
 - 2. 208 Volt System: Black.
 - 3. Fire Alarm System: Red.
 - 4. Telephone System: Blue.
- D. Legend:
 - 1. 480 Volt System: Orange.
 - 2. 208 Volt System: Black.
 - 3. Fire Alarm System: Red.
 - 4. Telephone System: Blue.

2.04 UNDERGROUND WARNING TAPE

- A. Description: 4 inch (100 mm) wide plastic tape, detectable type colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

- A. Install nameplates and labels parallel to equipment lines.
- B. Secure nameplates to equipment front using adhesive.
- C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Identify conduit using field painting under provisions of Division 1.
 - 1. Paint colored band on each conduit longer than 6 feet (2 m).
 - 2. Paint bands 20 feet (6 m) on center.
 - 3. Colors:
 - a. 480 Volt System: Orange.
 - b. 208 Volt System: Black.
 - c. Fire Alarm System: Red.
 - d. Telephone System: Blue.
- E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches (75 mm) below finished grade.

END OF SECTION

SECTION 26 0573
OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL**1.01 RELATED DOCUMENTS**

- A. The provisions of Section 26 05 10, "General Electrical Requirements" and Section 26 27 26, "Wiring Devices".

1.02 REFERENCES

- A. National Electrical Manufacturer Association FU 1.
- B. National Electrical Code.

1.03 SUMMARY

- A. Circuit breakers (each type and style).
- B. Circuit breaker handle padlock assembly.
- C. Fuses (each type and style).
- D. Disconnect switches (each type and size).
- E. Enclosures (each type and style).

1.04 WARRANTY

- A. Warranty shall comply with the provisions of Section 26 05 10, "General Electrical Requirements".

PART 2 PRODUCTS**2.01 CIRCUIT BREAKERS**

- A. Circuit breakers for panelboards, distribution panelboards, distribution switchboards, and main service equipment shall be the manufactured product of the same manufacturer as the equipment in which the circuit breaker is installed.
- B. Circuit breakers for panelboards and distribution panelboards shall be bolt-on type. Handle ties and dual, quad or tandem breakers are not acceptable. Mounting hardware, accessories, faceplates, enclosures, etc., shall be provided as required. Each and every circuit breaker shall be provided with a handle padlock attachment. This attachment shall allow the circuit breaker to be padlocked in either the "ON" or "OFF" position. Circuit breakers for distribution switchboards and main service equipment shall be as specified in Section 26 24 16, "Panelboards".
- C. Circuit breakers shall be quick-break on manual and automatic operation, and the handle mechanism shall be trip-free to prevent holding contact closed against a short circuit or sustained overload. Contacts shall be of high pressure butt-type and shall be made of a silver alloy material. Arc chutes shall be provided. Automatic thermal and magnetic tripping devices shall be located in each pole for the breaker. The thermal device shall provide time delay tripping on overloads and the magnetic device shall provide instantaneous tripping on short circuits. Circuit breakers with frame sizes above 100 amperes shall have an instantaneous-magnetic trip adjustment of ten times the circuit breaker's continuous amp rating (unless otherwise indicated). These adjustments shall be accessible from the front of the breaker.
- D. Circuit breakers used for switching lighting loads directly shall be approved Type "SW".
- E. Circuit breakers used to control motor loads directly shall be approved Type "HACR".
- F. Short circuit interrupting capacity shall be as indicated on the plans and shall in no case be less than 10,000 amps symmetrical at 208/120 volt.
- G. Circuit breakers provided for installation in existing switchboards or panelboards shall be of the same manufacturer as the existing switchboards or panelboards. The minimum A.I.C. shall not be less than that of the lowest rated device in the existing switchboard or panelboard.

2.02 FUSES:

- A. Fuse identification labels, showing size and type installed, shall be placed inside the cover of each switch or fused circuit breaker.
- B. All fuses shall be of one (1) manufacturer unless otherwise noted to ensure selective operation of protective devices.
- C. Fuses shall be as manufactured by Bussmann, Gould-Shawmut, or Brush unless otherwise indicated.
- D. Fuses shall be of the following type:
 - 1. Fuses 601 A through 6000 A serving all type of loads shall be U.L. Class L, type KRP-C.
 - 2. Fuses installed in safety switches at motor locations shall be 600 V, FRS or 250V, FRN.
 - 3. Fuses 1/10 A through 600 A shall be U.L. Class RK1; 600V, LPS-RK; 250V, LPN-RK, unless otherwise noted.
- E. Spare fuses shall be provided in the amount of 20 percent of each size and type installed, but in no case shall be less than three (3) of each specified size and type supplied. These spares shall be neatly enclosed in a suitable cabinet or cabinets.

2.03 DISCONNECT SWITCHES:

- A. The disconnect switches shall be heavy duty 240 volt type, externally operated, quick-made, quick-break knife switches, fused or non-fused as required. The number of poles and ampere rating shall be as shown on plans. Fused switches shall have Class "R" rejection features. All switches shall have a U.L. listed short circuit withstand rating. Switches in interior dry location shall be NEMA 1 enclosures. Switches in damp or exterior locations shall have NEMA 3R raintight enclosures. Switches shall be horsepower rated, unless otherwise specified.
- B. If double lugging or oversized wires are required, provide a wireway or splice box.
- C. Provide fuses as specified in this section. Fuses shall be installed so that the rating is clearly visible without removing fuse.
- D. Provide a nameplate on each switch as specified in Section 26 05 53, "Electrical Identification". Nameplate shall indicate load served, source and circuit number.
- E. Submit data on switches with drawings of the main switchboard, distribution switchboards or distribution panelboards, where switches are an assembled part.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Bolted connections shall be torque-tightened to manufacturer's specifications.
- B. Clipping of wires from standard cable to fit connector shall not be permitted. Appropriate connecting device shall be provided for multiple cable connections.
- C. Install disconnect switches in locations shown on plans. Test switches a minimum of three (3) times to ensure correct operation.

3.02 TESTS:

- A. Each and every circuit breaker shall be tested under load a minimum of three (3) times.

END OF SECTION

SECTION 26 05 75**OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY****1. PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.
 - 1. Coordination of series-rated devices is permitted where indicated on Drawings.

1.03 SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.
- C. Qualification Data: For coordination-study specialist.
- D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals **shall** be in digital form.
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report.
 - 4. Arc Flash Study.

1.04 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

2. PART 2 PRODUCTS**2.01 COMPUTER SOFTWARE DEVELOPERS**

- A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CGI CYME.
 - 2. EDSA Micro Corporation.
 - 3. ESA Inc.
 - 4. Operation Technology, Inc.
 - 5. SKM Systems Analysis, Inc.

2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.
 - 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 - 1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.
 - 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - e. Busway ampacity and impedance.
 - f. Motor horsepower and code letter designation according to NEMA MG 1.
 - 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.

- d. Ratings, types, and settings of utility company's overcurrent protective devices.
- e. Special overcurrent protective device settings or types stipulated by utility company.
- f. Time-current-characteristic curves of devices indicated to be coordinated.
- g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.03 FAULT-CURRENT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 1. Switchgear and switchboard bus.
 2. Distribution panelboard.
 3. Branch circuit panelboard.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, IEEE 241 and IEEE 242.
 1. Transformers:
 - a. ANSI C57.12.10.
 - b. ANSI C57.12.22.
 - c. ANSI C57.12.40.
 - d. IEEE C57.12.00.
 - e. IEEE C57.96.
 2. Medium-Voltage Circuit Breakers: IEEE C37.010.
 3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 4. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:
 1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
 2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on low and medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.
- F. Equipment Evaluation Report:
 1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.

3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.04 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
 1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
 3. Calculate the maximum and minimum ground-fault currents.
- B. Comply with IEEE 141, IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.
- C. Transformer Primary Overcurrent Protective Devices:
 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.
- E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.

- f. Transformer inrush points.
- g. Maximum fault-current cutoff point.
- G. Completed data sheets for setting of overcurrent protective devices.

3.05 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2015. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 3.03) and the protective device time-current coordination analysis (Section 3.04)
- B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. Circuits 240V or less where available bolted short circuit current is less than 10 kA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E Table 130.7(C)(9)(a), including footnote 3.
- D. Circuits 240V or less fed by transformers 112.5 kVA or less may be omitted from the computer model and will be assumed to have a hazard risk category 0 per IEEE 1584.
- E. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
- F. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- G. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

- H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
 - 1. Fault contribution from induction motors should not be considered beyond 5 cycles.
- I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- K. Mis-coordination should be checked amongst all devices within the branch containing the

immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

- L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- M. Provide the following:
 - 1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
 - 2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
 - 3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

3.06 FIELD ADJUSTMENT

- A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

3.07 ARC FLASH LABELS

- A. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
 - 1. UL969 – Standard for Marking and Labeling Systems
 - 2. ANSI Z535.4 – Product Safety Signs and Labels
 - 3. NFPA 70 (National Electric Code) – Article 110.16
- C. The label shall include the following information:
 - 1. System Voltage
 - 2. Flash protection boundary
 - 3. Personal Protective Equipment category
 - 4. Arc Flash Incident energy value (cal/cm²)
 - 5. Limited, restricted, and prohibited Approach Boundaries
 - 6. Study report number and issue date
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.
- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
 - 1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
 - 2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
 - 3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards as-

sociated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Label Installation

1. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.08 ARC FLASH TRAINING

The vendor supplying the Arc Flash Hazard Analysis shall train the Owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes photoelectric relays, occupancy sensors, and multiple lighting relays and contactors.
- B. Related Sections include the following:
 - 1. Division 26 Section 26 27 26 – "Wiring Devices" for wall-box dimmers and manual light switches.

1.03 SUBMITTALS

- A. Product Data: Include dimensions and data on features, components, and ratings for lighting control devices.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 1– Operation and Maintenance Data.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.
- C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.

1.05 COORDINATION

- A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

PART 2 PRODUCTS**2.01 PRODUCTS**

- A. Contactors and Relays:
- B. Photoelectric Relays:
- C. Occupancy Sensors:

2.02 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

2.03 PHOTOELECTRIC RELAYS

- A. Description: Solid state, with single-pole, double-throw dry contacts rated to operate connected relay or contactor coils or microprocessor input and complying with UL 773A.
- B. Light-Level Monitoring Range: 0 to 3500 fc, with an adjustment for turn-on/turn-off levels.
- C. Time Delay: Prevents false operation.

- D. Outdoor Sealed Units: Weathertight housing, resistant to high temperatures and equipped with sun-glare shield.

2.04 OCCUPANCY SENSORS

- A. Ceiling-Mounting or Wall Mounted Units: Unit receives control power from a separately mounted auxiliary power and control unit and operates power switching contacts in that unit.
- B. Ceiling-Mounting Units for use with programmable, microprocessor-based systems: Unit receives 24-V dc power from a remote source and, on sensing occupancy, closes contacts that provide signal input the lighting control system.
- C. Switch-Box-Mounting Units: Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts rated 800 W at 120-V ac, and 1000 W at 277-V ac, minimum.
- D. Operation: Turns lights on when room or covered area is occupied and off when unoccupied, unless otherwise indicated.
 - 1. Time Delay for Turning Lights Off: Adjustable over a range from 1 to 15 minutes, minimum.
 - 2. Manual Override Switch for switch-box mounted units: Turns lights off manually regardless of elapsed time delay.
 - 3. Isolated Relay Contact: Operates on detection of occupancy or vacancy, as indicated, to activate an independent function (refer to Section 15940 – Sequences of Operation).
- E. Auxiliary Power and Control Units: As follows:
 - 1. Relays rated for a minimum of 20-A normal ballast load or 13-A tungsten filament or high-inrush ballast load.
 - 2. Sensor Power Supply: Rated to supply the number of connected sensors.
- F. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in the field by selection of jumpers or dip-switches on unit.

2.05 MULTIPOLE CONTACTORS AND RELAYS

- A. Description: Electrically operated and mechanically held and complying with UL 508 and NEMA ICS 2.
 - 1. Current Rating for Switching: UL listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballasts with 15 percent or less total harmonic distortion of normal load current).
 - 2. Control Coil Voltage: Match control power source.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Mount lighting control devices according to manufacturer's written instructions.
- C. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

3.02 CONTROL WIRING INSTALLATION

- A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Section 26 05 19 – "Wires and Cables" for low-voltage connections.
- B. Wiring Method: Install all wiring as specified in Division 26 Section 26 05 33 – "Raceways and Fittings."
- C. Bundle, train, and support wiring in enclosures.

- D. Ground equipment.
- E. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 – "Electrical Identification."

3.04 FIELD QUALITY CONTROL

- A. Schedule visual and mechanical inspections and electrical tests with at least seven days advance notice.
- B. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
- C. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.
- D. Verify settings of photoelectric devices with photometer calibrated within previous six months.
- E. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
 - 1. Continuity tests of circuits.
 - 2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - a. Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.05 CLEANING

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel as specified below:
 - 1. Train owner maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of three hours training.
 - 2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
 - 3. Schedule training with owner, through Architect, with at least seven days advance notice.

3.07 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

END OF SECTION

SECTION 26 2413 SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Switchboards.
- B. Switchboard accessories.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.
- B. Section 26 05 26 - Grounding and Bonding.

1.03 REFERENCES

- A. ANSI C12.1 - American National Standard Code for Electricity Metering; 2008.
- B. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992).
- C. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts; International Electrotechnical Commission; 1997.
- D. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters International Electrotechnical Commission; 1984.
- E. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.
- F. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 1993 (R 2003).
- G. NECA 400 - Recommended Practice for Installing and Maintaining Switchboards; National Electrical Contractors Association; 2007.
- H. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- I. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2012.
- J. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- K. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- L. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- D. Test Reports: Indicate results of factory production tests.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- F. Project Record Documents: Record actual locations of switchboards.
- G. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in 48 inch (219 mm) maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.07 MAINTENANCE MATERIALS

- A. See Section 01600 - Product Requirements, for additional provisions.
- B. Furnish two of each key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.
- B. GE Industrial: www.geindustrial.com.
- C. Square D: www.squared.com.
- D. Siemens: www.sea-siemens.com

2.02 SWITCHBOARDS

- A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- B. Ratings:
 - 1. Voltage: 208/120 volts.
 - 2. Configuration: Three phase, four wire, grounded.
 - 3. Main Bus: As indicated on the single line diagram.
 - 4. Integrated Equipment Rating: As indicated in the single line diagram (rms amperes symmetrical).
- C. Main Section Devices: Panel mounted.
- D. Distribution Section Devices: Panel mounted.
- E. Auxiliary Section Devices: Individually mounted.
- F. Bus Material: Copper, standard size.
- G. Bus Connections: Bolted, accessible from front for maintenance.
- H. Fully insulate load side bus bars. Do not reduce spacing of insulated bus.
- I. Ground Bus: Extend length of switchboard.
- J. Insulated Ground Bus: Extend length of switchboard.
- K. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.

1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
2. Include shunt trip and undervoltage release where indicated.
- L. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- M. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.
- N. Pull Section:
 1. In accordance with utility company's requirements.
- O. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- P. Enclosure: Type 1 - General Purpose; Type 3R - Raintight.
 1. Align sections at rear only.
 2. Switchboard Height: 90 inches (2250 mm), excluding floor sills, lifting members and pull boxes.
 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.03 SOURCE QUALITY CONTROL

- A. Shop inspect and test switchboard according to NEMA PB 2.
- B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify engineer at least 7 days before inspection is allowed.
- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify engineer at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide concrete housekeeping pad under the provisions of Section 03300.
- B. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.
- B. Install in a neat and workmanlike manner, as specified in NECA 400.
- C. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- D. Install fuses in each switch.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

3.04 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.
- C. Adjust circuit breaker trip and time delay settings to values indicated.
- D. Adjust circuit breaker trip and time delay settings to values as instructed by engineer.

3.05 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

NOT FOR BID

**SECTION 26 2416
PANELBOARDS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.

1.02 RELATED SECTIONS

- A. Section 26 05 26 - Grounding and Bonding.
- B. Section 26 05 53 - Identification for Electrical Systems.
- C. Section 26 28 13 - Fuses.

1.03 REFERENCES

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- D. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.
- E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 MAINTENANCE MATERIALS

- A. Furnish two of each panelboard key.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.
- B. GE Industrial: www.geindustrial.com.
- C. Square D: www.squared.com.
- D. Siemens: www.sea-siemens.com

2.02 POWER DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1, circuit breaker type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: As indicated.
 - 1. 208 Volt Panelboards: 10,000 amperes rms symmetrical.
 - 2. 480 Volt Panelboards: 14,000 amperes rms symmetrical.
- D. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.
- E. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- F. Enclosure: NEMA PB 1, Type 1 or 3R, 6 inches (153 mm) deep, 20 inches (508 mm) wide, cabinet box.
- G. Cabinet Front: Surface type, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- C. Minimum Integrated Short Circuit Rating: As indicated.
 - 1. 208 Volt Panelboards: 10,000 amperes rms symmetrical.
 - 2. 480 Volt Panelboards: 14,000 amperes rms symmetrical.
- D. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Do not use tandem circuit breakers.
- E. Enclosure: NEMA PB 1, Type 1 or 3R.
- F. Cabinet Box: 6 inches (153 mm) deep, 20 inches (508 mm) wide for 240 volt and less panelboards, 20 inches (508 mm) wide for 480 volt panelboards.
- G. Cabinet Front: Flush or surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 26 0553.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling or below floor. Identify each as SPARE.
 - 1. Minimum spare conduits: 5 empty 1 inch (DN27).
- H. Ground and bond panelboard enclosure according to Section 26 0526.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.03 ADJUSTING

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 2701
ELECTRICAL UTILITY SERVICES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Service racks.
- B. Metering transformer cabinets.
- C. Meter bases.

1.02 RELATED SECTIONS

- A. Section 26 24 13 - Switchboards: Metering transformer compartment.

1.03 REFERENCES

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SYSTEM DESCRIPTION

- A. System Characteristics: 480Y/277 volts, single phase, two-wire, 60 Hertz.
- B. Service Entrance:

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.
- C. Submit utility company-prepared drawings.

1.06 QUALITY ASSURANCE

- A. Utility Company:
- B. Perform work in accordance with utility company written requirements and NFPA 70.
 - 1. Maintain one copy of each document on site.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 PRE-INSTALLATION MEETING

- A. Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. GE Industrial: www.geindustrial.com.
- B. Milbank Manufacturing: www.milbankmfg.com.
- C. Square D: www.squared.com.
- D. Siemens
- E. Cutler Hammer.

2.02 COMPONENTS

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
 - 1. Size: As required by utility.
- B. Meter Base: Furnished by utility company.
- C. Utility Transformer Pad: Prefabricated precast concrete transformer pad sized as required by utility company.

1. Manufacturers:
 - a. NewBasis (Associated Plastics): www.newbasis.com.
 - b. Formex Manufacturing: www.formex.com.
 - c. Highline Products: www.highlineproducts.com.
- D. Other Components: As required by utility company.

PART 3 EXECUTION

3.01 PREPARATION

- A. Arrange with utility company to obtain permanent electric service to the Project.
- B. Verify that field measurements are as indicated on utility company drawings.

3.02 INSTALLATION

- A. Install service rack, weatherhead, transformer pad, metering transformer cabinets, and meter base as required by utility company.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

END OF SECTION

**SECTION 26 2726
WIRING DEVICES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Device plates and decorative box covers.
- E. Floor box service fittings.
- F. Access floor boxes.

1.02 RELATED SECTIONS

- A. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.03 REFERENCES

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 2002 (R 2008).
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturer's Installation Instructions.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Cooper Wiring Devices: www.cooperwiringdevices.com.
- B. GE Industrial: www.geindustrial.com.
- C. Leviton Manufacturing, Inc: www.leviton.com.

2.02 WALL SWITCHES

- A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
 - 1. Body and Handle: White plastic with toggle handle.
 - 2. Indicator Light: Light handle type switch.
 - 3. Locator Light: Lighted handle type switch; red color handle.
 - 4. Ratings:

- a. Voltage: 120 - 277 volts, AC.
- b. Current: 20 amperes.

B. Switch Types: Single pole, double pole, 3-way, 4-way, pilot gang, and locator.

2.03 WALL DIMMERS

- A. Wall Dimmers: Semiconductor dimmer for incandescent lamps, Type as indicated on drawings, complying with NEMA WD 6 and WD 1.
 - 1. Body and Handle: White plastic with linear slide.
 - 2. Voltage: 120 volts.
 - 3. Power Rating: Match load shown on drawings; 600 watts minimum.
- B. Accessory Wall Switches: Match dimmer appearance.

2.04 RECEPTACLES

- A. Receptacles: Heavy duty, industrial type, complying with NEMA WD 6 and WD 1.
 - 1. Device Body: White plastic – Normal power, Red plastic – Emergency power
 - 2. Configuration: NEMA WD 6, type as specified and indicated.
- B. Convenience Receptacles: Type 5 - 20.
- C. Single Convenience Receptacles.
- D. Duplex Convenience Receptacles.
- E. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.05 WALL PLATES

- A. Decorative Cover Plates: White, smooth plastic.
- B. Jumbo Cover Plates: White, smooth plastic.
- C. Weatherproof Cover Plates: Gasketed cast metal with hinged.
- D. Covers for weatherproof receptacles shall be such that the weatherproof integrity of the receptacle is maintained while in use.

2.06 FLOOR MOUNTED SERVICE FITTINGS

- A. Pedestal Convenience Receptacles:
 - 1. Housing: Satin aluminum.
 - 2. Device Plate: Stainless steel.
 - 3. Configuration: One duplex.
- B. Flush Cover Convenience Receptacles:
 - 1. Material: Brass.
 - 2. Configuration: Duplex flap opening.
- C. Pedestal Communication Outlets:
 - 1. Housing: Satin aluminum.
 - 2. Device Plate: Stainless steel.
- D. Flush Cover Communication Outlets:
 - 1. Material: Brass.
 - 2. Configuration: 2-1/8 inch (54 mm) x 1 inch (25 mm) combination threaded opening.
- E. Pedestal Combination Fittings:
 - 1. Housing: Satin aluminum.
 - 2. Device Plate: Stainless steel.

3. Configuration: One duplex convenience receptacle with one bushed opening, 1 inch (25mm) inside diameter.
- F. Flush Cover Combination Fittings:
 1. Material: Brass.
 2. Configuration: Duplex flap opening with 2-1/8 inch (54 mm) x 1 inch (25 mm) combination threaded opening.
- G. Protective Ring: Brass finish.
- H. Split Nozzles: Brass finish.
- I. Carpet Rings: Brass.

2.07 ACCESS FLOOR BOXES

- A. Manufacturers:
 1. Arc-Co./Division of Arcade Technology: www.arc-co.com.
 2. Unity Manufacturing: www.unitymfg.com.
- B. Floor Boxes: As specified in Section 26 0534.
- C. Access Floor Boxes: Sheet metal box suitable for mounting in access floor system.
 1. Size: 4 x 4.
 2. Cover: Impact resistant plastic with grey enamel finish.
 3. Convenience Receptacle: One with isolated ground.
 4. Communications Receptacle: modular jack.
 5. Data Receptacle: One.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that floor boxes are adjusted properly.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- E. Verify that openings in access floor are in proper locations.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on top.
- G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Use jumbo size plates for outlets installed in masonry walls.

- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- L. Install protective rings on active flush cover service fittings.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 0534 to obtain mounting heights specified and indicated on drawings.
- B. Install wall switch 48 inches (1.2 m) above finished floor.
- C. Install convenience receptacle 18 inches (450 mm) above finished floor.
- D. Install convenience receptacle 6 inches (150 mm) above counter.
- E. Install dimmer 48 inches (1.2 m) above finished floor.
- F. Install telephone jack 18 inches (450 mm) above finished floor.
- G. Install telephone jack for side-reach wall telephone to position top of telephone at 54 inches (1.4 m) above finished floor.
- H. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches (1.2 m) above finished floor.
- I. Coordinate installation of access floor boxes with access floor system provided under Section 10270.
- J. Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 0534.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.
- G. Verify that each telephone jack is properly connected and circuit is operational.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 2813
FUSES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Fuses.
- B. Spare fuse cabinet.

1.02 REFERENCES

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data sheets showing electrical characteristics, including time-current curves.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.05 MAINTENANCE MATERIALS

- A. See Section 01600 - Product Requirements, for additional provisions.
- B. Furnish two fuse pullers.
- C. Furnish three of each size and type fuse installed.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Cooper Bussmann: www.bussmann.com.
- B. Ferraz Shawmut, Inc: www.ferrazshawmut.com.
- C. Littelfuse: www.littelfuse.com.

2.02 FUSES - GENERAL

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.
- C. Main Service Switches Larger than 600 amperes: Class L (time delay).
- D. Main Service Switches: Class RK1 (time delay).
- E. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).
- F. Power Load Feeder Switches: Class RK1 (time delay).
- G. Motor Load Feeder Switches: Class RK1 (time delay).
- H. Lighting Load Feeder Switches Larger than 600 amperes: Class L time delay.
- I. Lighting Load Feeder Switches: Class RK1 (time delay).
- J. Other Feeder Switches Larger than 600 amperes: L time delay; L fast-acting.
- K. Other Feeder Switches: Class RK1 (time delay).
- L. General Purpose Branch Circuits: Class RK1 (time delay).

- M. Motor Branch Circuits: Class L time delay.
- N. Lighting Branch Circuits: Class G.

2.03 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.
- B. Doors: Hinged, with hasp for padlock.
- C. Finish: Prime finish for field painting.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- B. Install spare fuse cabinet where indicated.

END OF SECTION

SECTION 26 2816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Fusible switches.
- B. Nonfusible switches.

1.02 RELATED SECTIONS

- A. Section 26 28 13 - Fuses.

1.03 REFERENCES

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.
- B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide switch ratings and enclosure dimensions.
- C. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.
- B. GE Industrial: www.geindustrial.com.
- C. Square D: www.squared.com.
- D. Siemens: www.sea-siemens.com

2.02 COMPONENTS

- A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - 2. Handle lockable in OFF position.
 - 3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.
- B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - 2. Handle lockable in OFF position.

- C. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install fuses in fusible disconnect switches.
- C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.

END OF SECTION

SECTION 26 3001
DIESEL EMERGENCY GENERATOR SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. It is the intent of these specifications to secure for the purchaser a generator set of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. Major system components including the generator set, base mounted fuel storage tank, automatic transfer switch, and maintenance agreement, shall be provided by one equipment supplier who shall be responsible for the compatibility of the components and warranty for all items. The equipment supplied and the installation shall meet the applicable requirements of the latest editions of the following codes and regulations:

1. California Administrative Code (CAC)

CAC Title 24	State of California Administration Code, Title 24, Building Standards
CAC Title 19	State of California Administration Code, Title 19, Public Safety
2. Code of Federal Regulations (CFR) CFR 1910

Occupational Safety and Health Standards
3. Electrical Generating Systems Association (EGSA)

EGSA 100B	Performance Standard for Engine Cranking Batteries Used with Engine Generator Sets
EGSA 100C	Performance Standard for Battery Chargers for Engine Starting Batteries and Control Batteries
EGSA 100D	Performance Standard for Generator Overcurrent Protection 600 Volts and Below
EGSA 100E	Performance Standard for Governors on Engine Generator Sets
EGSA 100F	Performance Standard for Engine Protection Systems
EGSA 100G	Performance Standard for Generator Set Instrumentation, Control and Auxiliary Equipment
EGSA 100M	Performance Standard for Multiple Engine Generator Set Control Systems
EGSA 100S	Performance Standard for Transfer Switches for Use with Engine Generator Sets
EGSA 100T	Diesel Fuel Systems for Engine Generator Sets with Above Ground Steel Tanks
4. International Conference of Building Officials (ICBO)

ICBO UBC	Uniform Building Code
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

IEEE 115	Synchronous Machines

IEEE 126	Speed Governing of Internal Combustion Engine-Generator Units
IEEE 421.1	Definitions for Excitation Systems for Synchronous Machines
IEEE C37.2	Electrical Power System Device
6. National Electrical Manufacturers Association (NEMA)	
NEMA 250	Enclosures for Electrical Equipment (1000 volts Maximum)
NEMA AB 1	Molded Case Circuit Breakers and Molded Case Switches
NEMA MG 1	Motors and Generators
NEMA PB 2	Deadfront Distribution Switchboards
NEMA/ICS 1	Industrial Control and Systems
NEMA/ICS 2	Controllers, Contactors and Overload Relays, Rated not more than 2000 Volts AC or 750 Volts DC
NEMA/ICS 2-447	Standard for Automatic Transfer Switches
NEMA/ICS 6	Industrial Control and Systems Enclosures
7. National Fire Protection Association (NFPA)	
NFPA 20	Centrifugal Fire Pumps
NFPA 30	Flammable and Combustible Liquids Code
NFPA 37	Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	National Electrical Code
NFPA 70B	Electrical Equipment Maintenance
NFPA 99	Health Care Facilities
NFPA 101	Life Safety Code
NFPA 110	Emergency and Standby Power Systems
8. Underwriters Laboratories Inc. (UL)	
UL 142	Steel Above Ground Tanks
UL 429	Electrically Operated Valves
UL 489	Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 1008	Automatic Transfer Switches
UL 1236	Battery Chargers for Charging Engine-Starter Batteries
UL 2200	Stationary Engine Generator Assemblies
9. Regional Codes and Regulations	
	County of San Bernardino Noise Ordinance
	South Coast Air Quality Management District

- B. All equipment shall be new, of current domestic production of a national firm which manufacturers the engine-generator set as a matched unit, and whose quality control program complies with ISO Standards and that is certified to ISO-9001. The manufacturer together with its authorized local representative shall have full responsibility for the performance of the generator set and its accessories. Unit shall be designed for outdoor installation. Generator

set shall be built and labeled in accordance with UL 2200. Both the generator set and the automatic transfer switch shall be seismically certified in accordance with ICBO Uniform Building Code.

- C. Supplier shall maintain a parts and service facility within 50 miles of the installation site, employ factory trained technicians, and offer 24-hour emergency service. Supplier shall be the authorized dealer of a manufacturer offering standard production equipment built and prototype tested in accordance with NFPA 110, and shall be authorized to administer the warranty for all components of the emergency generator system specified herein.

1.02 SUBMITTALS

- A. Submittals shall be provided in sufficient detail to demonstrate compliance with these specifications. As a minimum, the submittal shall be bound, provided with an index to cross-reference the submittal item and page location, marked to indicate the specific item to be provided, and include the following data.
1. Bill of Material, covering all equipment submitted.
 2. Qualifications of engine-generator manufacturer and of the authorized distributor. ISO-9001 certification. 24-Hour emergency service capability.
 3. Manufacturer's published rating sheet. NFPA-110 prototype test verification. Altitude and temperature derating procedures. Frequency and voltage regulation. Cooling system capability. Full rated load pickup capability. Certification of UL 2200 compliance.
 4. Installation requirements: radiator airflow and backpressure capacity, combustion air requirement, fuel consumption, fuel circulation, heat rejection, exhaust flow, exhaust back-pressure calculations, battery requirements. Floor layout dimensional data with provision for cable entry and termination.
 5. Engine performance data. Configuration, cubic inch displacement, rated RPM, type of aspiration, voltage of electrical system, oil and coolant capacities, exhaust volume and temperature.
 6. Exhaust emission data provided on the current application form for the air quality agency having jurisdiction. Exhaust and crankcase emission control equipment devices.
 7. Battery set and battery charger.
 8. Generator performance data. Motor and load starting capability verification. Temperature rise and insulation classification. Short circuit sustaining capability. Over-voltage safety shutdown. Decrement curve for specific voltage specified.
 9. Output circuit breaker size, manufacturer, model, and trip curve for 10 second short-circuit capability.
 10. Control panel features and performance. Meters and gauges. Safety alarm and shutdown devices. Cranking control. Indicator lamps and horn. Control switches. Rodent protection. Remote communication.
 11. Exhaust silencer attenuation rating.
 12. Jacket water heater system.
 13. Fuel system. Alarm and indicator devices. Dimensional data. Shutoff valves, fuel strainer, and flexible hose. Fuel purifier.
 14. Fuel storage system. Compliance with UL-142. Alarm and indicator devices. Dimensional data. Fuel capacity and hours of operation possible. Seismic restraint devices and calculations for fuel tank.
 15. Remote annunciator panel. Dimensional data.

16. Seismic restraint devices and certification. Agency pre-qualification. Dimensional data. Seismic restraint calculations. Seismic certification of the generator set and automatic transfer switch in accordance with ICBO Uniform Building Code.
17. Generator set enclosure. Material and construction details. Dimensional data. Sound attenuation data when specified. Compatibility with cooling requirements of generator set at rated load and specified ambient conditions.
18. Automatic transfer switch performance data. Agency acceptance. Withstand current rating. Standard and optional features included. Dimensional data.
19. Schematic and wiring diagrams for all major components. Interconnection diagram for all major components.
20. Testing procedure.
21. Warranty certificate and administration authorization.
22. Preventative maintenance contract. Pollution liability insurance coverage and certificate.

1.03 RATING

- A. Unit shall be rated as indicated on drawings, three phase under standard conditions of 77 degrees F ambient. Rating shall be for continuous standby operation during any utility power failure. Rating shall be verified by published specification sheets of its nationally recognized manufacturer. Generator set shall be capable of accepting rated load in one step in accordance with NFPA-110 Para. 3-5.3.1.
- B. System voltage shall be 208y/120 volts, 3 phase, 4 wire, 60 Hertz. Generator shall be 12 lead type for possible future voltage changes.
- C. Generator set shall be by Generac, no substitutions will be allowed.

1.04 ENGINE

- A. The engine shall be 4-cycle, direct connected to the generator by a semi-flexible, coupling, and both shall be mounted on a common sub-base. The engine shall have sufficient power to produce the specified rating when operating at generator synchronous speed with all accessories required for normal operation including exhaust, fuel, cooling, and battery charging systems. Maximum engine speed shall be 1800 RPM. The engine shall have a pressure lubrication system and replaceable element oil filter. The engine oil drain shall be piped to the outside of the skid base and provided with a stainless steel ball-valve to facilitate draining. Provide a dry-type air cleaner with service indicator. Provide an engine driven battery charging alternator with a minimum capacity of 40 amps. Engine shall be certified by the Environmental Protection Agency (EPA) and shall meet current Tier code level of local APCD/AQMD.
- B. The engine shall be equipped with a fuel system suitable for operation on DF-2 diesel fuel with a sulfur content not to exceed 0.05 percent by weight. Fuel system shall include an engine driven transfer pump, replaceable filter, fuel purifier, and flexible fuel lines. Fuel system shall comply with the requirements of NFPA-37 and NFPA-110 Paragraph 5-9.
 1. Provide flexible fuel lines rated for duty at 300 degrees Fahrenheit and 100 psi.
- C. The engine cooling system shall be designed to provide adequate cooling at rated load, within the specified enclosure, in ambient temperatures up to 122 degrees Fahrenheit. The system shall include a unit mounted radiator, blower fan, water pump, and thermostat. Cooling system shall meet the performance requirements of NFPA-110 Para. 5-8.1. Provide a low water level shutdown device.
- D. The engine governor shall maintain frequency within a +/-0.25 percent band under steady state conditions and isochronous regulation from no-load to full load. Regulation shall be as defined by IEEE STD 126-1959/83. Governor performance shall comply with EGSA 100E.
- E. Starting shall be by means of a solenoid operated positive engagement gear driven electric starter for operation on 12 volt D.C. Note the cycle-crank requirement specified within the

generator control panel. Provide a primary and a secondary means of cranking termination in accordance with NFPA-110 Para. 3-5.4.2.

- F. Engine protective devices shall meet the performance requirements of EGSA 100F and shall include the following:
1. Overcrank - lockout
 2. Low oil pressure - preliminary alarm
 3. Low oil pressure - shutdown
 4. High water temperature - preliminary alarm
 5. High water temperature - shutdown
 6. Low water temperature - alarm
 7. Low water level - shutdown
 8. Overspeed - shutdown
 9. Low fuel level - alarm
- G. Provide vibration isolators installed between the engine generator base assembly and the support base. Note the seismic restraint requirements of paragraph 1.15.
- H. Engine crankcase emissions shall be filtered to prevent oil mist from contaminating the engine space and to comply with Air Pollution Control District requirements for visible emissions. Filters shall be of the closed cycle type. Filter device shall consist of a replaceable filter element and a removable reservoir for collected fluids. Filter shall be sized for the allowable crankcase backpressure established by the engine manufacturer.

1.05 AIR EMISSIONS

- A. Only EPA certified engines shall be considered and installed under the terms of this contract. The contractor shall provide adequate documentation to substantiate EPA certification of the engine. Documentation of EPA certification shall include, but not be limited to, engine certification number, engine model number, horsepower rating, certified emission rates of criteria pollutants, etc.
- B. Provide engine performance documentation, as required by SCAQMD Air Pollution Control District, to support the permit application. Application for the Authority to Construct, and the initial Permit to Operate, will be prepared, submitted, and paid for by the engine generator supplier or General Contractor.

CARB 3+Verified Passive Diesel Particulate Filter JM-CR

T(+)-1-N-CS-BITO-8/8-LP

The diesel particulate filter is Johnson Matthey's patented Continuous Regenerating Technology (CRT) system. The diesel particulate filter is comprised of an oxidation catalyst(s) in direct series with a ceramic filter element(s). If our Carbon steel version (CS) is called out, they are painted with high-temperature black paint, which can rust in a cosmetic fashion, and is not warranted. If our Stainless steel (SS) version is called out it is not painted and is much more resistant to rust.

The organic particulate matter in the engine exhaust is comprised of carbon soot, soluble organic fraction (unburnt HCs) and ash. The catalyst oxidizes the soluble organic fraction of PM to CO₂ and H₂O, oxidizes HC to CO₂ and H₂O, and some NO to NO₂. The NO₂ oxidizes the carbon soot that is collected downstream on the filter elements to CO₂, which regenerates the filter and called passive regeneration. Inorganic ash that is in the diesel exhaust will also be collected on the filter elements, and because this doesn't burn (oxidize) it necessitates the

eventual cleaning of the filter elements (for standby operation, this cleaning of ash will not be necessary for many years). Exhaust sound silencing is integrated with the diesel particulate filter as one complete assembly.

2.2 **SootAlert Module (Datalogger and Monitor)**

A Johnson Matthey CARB Verified SootAlert is provided with each CRT(+). The SootAlert monitors, logs the operation of the DPF and predicts when the filters will need regeneration by providing a Yellow-Light indicator when regeneration is needed soon, and a Red-Light indicator when regeneration is required immediately. The SootAlert will monitor the regeneration and indicate that regeneration is complete by providing a Green Light indicator, at which time the filters have successfully been regenerated. The SootAlert includes an Ethernet port for remote monitoring of the status of the filters. Both digital and analog outputs are available for remote signaling.



1.06 **BATTERY SET**

- A. A lead acid battery set shall be provided and installed on the generator base with seismic restraints. System voltage shall match that of the starter. Cold-cranking amperage capacity shall conform with the requirements of SAE Standard J-537 for zero degrees Fahrenheit. Performance of the battery system shall comply with EGSA 100B.

1.07 **BATTERY CHARGER**

- A. An automatic float/equalize type battery charger shall be provided, installed with vibration isolators, and wired on the generator set. Connections to the battery shall be solid wired (clip-on type clamps not acceptable). Input voltage shall be 120 volts AC. Charger shall be UL-1236 listed and UL-2200 compliant, and FCC Class A compliant for EMI and RFI. Output capacity shall be a minimum of 10 amps. Battery charger, with the generator control panel, shall meet the performance requirements of EGSA 100C, and shall include the characteristics required by NFPA-110 Para. 3-5.4.6. DC voltage regulation shall be within +/-1 percent from no load to full load and over an AC input line voltage variation of 90 – 135 VAC.
- B. Features of the charger, or in combination with the generator control panel, shall include the following:
 - 1. Automatic 3-stage "float-to-equalize" operation, with bulk, absorption, and float levels.
 - 2. Indicator lamps for Power On, AC Input and DC Output. Red and green LEDs shall indicate the level of charge.
 - 3. DC voltmeter and DC ammeter, digital readout, 0.5 percent full scale accuracy.
 - 4. Reverse polarity protection.
 - 5. AC input fuse protection.
 - 6. Automatic current limiting for short circuit protection.

7. Battery charger failure alarm contacts, set to close if AC power is lost to charger.
8. Low and high battery voltage alarm contacts, set to close if battery voltage drops below 90 percent or rises above 110 percent of rated.

1.08 GENERATOR

- A. The generator shall be 4-pole, revolving field, with rotating brushless or static exciter. It shall have a solid state 3-phase sensing voltage regulator capable of maintaining voltage within ± 0.25 percent at constant load from 0-100 percent of rating. Voltage regulator shall be of the volts-per-hertz type and NFPA-110 requirement for block loading, including 100% load pickup shall be met. The regulator shall be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads. Voltage regulator shall meet the performance standards of EGSA 100R.
- B. Generator shall be self-ventilated of drip-proof construction with amortisseur rotor winding and skewed for smooth voltage waveform. The insulation material shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall be limited to 130 degrees C as defined by NEMA standard (MG1-22.40 and 22.85). The generator shall have a single maintenance free bearing and shall be directly connected to the flywheel housing with a semi flexible coupling between the rotor and the flywheel. Provide a generator space heater, rated at 200 watts 120 VAC, to prevent moisture condensation on the generator windings during periods of non-operation.
- C. Generator set shall provide the following performance.
 1. On application of any load up to 100 percent of the rated load, the instantaneous voltage dip shall not exceed 20 percent and shall recover to ± 2 percent rated voltage within five seconds.
 2. The generator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system.
- D. A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished and shall not automatically reset preventing restoration of voltage if maintenance is being performed. This breaker shall protect the generator from damage due to its own high current capability and shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. Circuit breaker shall be Square D, or equal. Circuit breaker shall be installed in the generator terminal box and be easily operable when the operator is at the control panel. Circuit breaker shall include provision for a lock out device in the de-energized position to comply with NFPA 70E. Provide an auxiliary contact, wired to the generator controller, to indicate the circuit breaker is not closed.
- E. Provide generator over-voltage protection for sensitive loads that will shut the unit down when voltage exceeds 115 percent of rated for longer than 1 second.

1.09 GENERATOR CONTROLLER

- A. A solid state micro-processor controller shall be vibration isolated above the generator. The microprocessor control board shall be moisture proof and capable of operation from -40c to 85c. Relays will only be acceptable in high current circuits. Generator set instrumentation; control and auxiliary equipment shall meet the performance standards of EGSA 100G. The controller shall be listed under UL-508. Controller shall be capable of control and operation from a remote PC over telephone lines. The controller logic shall support Modbus® RTU industry standard open communication protocol.
- B. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:
 1. Fused DC circuits.

2. Complete two-wire start/stop control which shall operate on closure of a remote contact.
 3. Speed sensing and a second independent starter motor disengagement systems shall protect against the starter engaging with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
 4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter. Automatic restart feature shall initiate the start routine and recrank if the generator slows to less than 390 rpm after exceeding crank disconnect speed.
 5. Cranking cyler shall be programmable. One to six cranking cycles and cranking time of 1-60 seconds shall be possible. Set for initial operation with three cranking cycles of 15-seconds each with 15 second rest periods.
 6. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
 7. Engine cool down timer factory set at five minutes to permit unloaded running of the standby set after transfer of the load to normal. Controller shall operate the engine at idle speed during the cool down period.
 8. Three-position (Automatic – Off/Reset - Run) selector switch. In the "Run" position, the engine shall start and run regardless of the position of the remote starting contacts. In the automatic position, the engine shall start when contacts in the remote control circuit close and stop five minutes after those contacts open. In the off position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault lamp shall also be accomplished by putting the switch to the off/reset position.
 9. Time delay on engine starting (adjustable 0-6 seconds) and time delay transfer to emergency (adjustable 0-5 minutes). These time delays may be provided as part of the automatic transfer switch specified in paragraph 15.6.
- C. An engine and generator instrument panel shall be installed on the unit with vibration isolators, and include the following:
1. Displays:
 - a. AC Voltmeter (L-L and L-N for all phases), digital, +/-0.25% accuracy
 - b. AC Ammeter (L1, L2, L3), digital, +/-0.25% accuracy
 - c. Frequency meter, digital, +/-0.5% accuracy
 - d. Wattmeter (total per phase), digital, +/-0.5% accuracy
 - e. KVA (total per phase), digital, +/-0.5% accuracy
 - f. Percent alternator duty level, Actual kW/kW rating
 - g. Power factor per phase, leading/absorbing
 - h. Battery Voltmeter, digital, 1% accuracy
 - i. Engine coolant temperature, digital, 1% accuracy
 - j. Engine oil pressure, digital, 1% accuracy
 - k. Running time meter
 - l. Ambient temperature, digital, 1% accuracy (delete- not available)
 2. Shutdown and Warning Text Messages:
 - a. Overcrank lockout
 - b. Low oil pressure – preliminary alarm
 - c. Low oil pressure – shutdown
 - d. High oil temperature – shutdown

- e. High coolant temperature – preliminary alarm
 - f. High coolant temperature – shutdown
 - g. Low coolant temperature – alarm
 - h. Low coolant level – shutdown
 - i. Overspeed – shutdown
 - j. Low fuel level – alarm
 - k. Water in fuel purifier – alarm
 - l. Generator over-voltage – shutdown
 - m. Generator under-voltage – shutdown
 - n. Generator over-frequency shutdown
 - o. Generator under-frequency – shutdown
 - p. High battery voltage – alarm
 - q. Low battery voltage – alarm
 - r. Generator overcurrent – alarm
 - s. Generator running – alarm
 - t. Circuit breaker open - alarm
3. Control Functions:
- a. AC output voltage adjustment, 5% of L-L output voltage
 - b. Alternator protection, overload and short circuit matched to rated voltage and current output
 - c. Automatic restart
 - d. Clock and Calendar, real-time clock and calendar to time stamp shutdowns for e. local display and remote monitor.
 - e. Digital voltage regulator, to provide +/-0.25% voltage regulation
 - f. Display power shutdown, set at 5 minutes
 - g. Fault shutdown override switch, to provide the ability to override the
 - h. normal fault shutdowns except emergency stop and overspeed, in emergency situations and during diagnostic operation.
 - i. Record and display the number of generator starts.
 - j. Idle speed function, to permit operation at idle speed for a selectable time period.
 - k. Modbus® Interface
 - l. Password protected programming access
 - m. Programmable run function for user selectable time for exercising the generator set. (ATS Function)
 - n. Remote reset capability, initiated via the remote communication package.
 - o. Running time hour meter, to record real time loaded and unloaded run time.
 - p. Time delay engine cool down, for user selectable time delay before the generator set shuts down.
 - q. Time delay engine start, for user selectable time delay before the generator set starts.
4. Alarm horn, with silence switch, to meet the requirements of NFPA 110. Note: Silencing this horn after one fault, i.e. low fuel shall not prevent it from sounding again should a different fault condition occur.

- D. Complete control panel shall be "rodent proofed" to prevent damage to components by small rodents.

1.10 EXHAUST SYSTEM

- A. A critical degree silencer shall be provided and installed inside the generator set enclosure. Supplier shall furnish back pressure calculations for the installation verifying that engine limitation is not exceeded. Silencer shall be arranged for horizontal mounting with bottom (side) inlet and end outlet. Provide a stainless steel bellows type flexible exhaust connector at the engine exhaust outlet. Provide a long radius type elbow to discharge exhaust gases vertically. Provide suitable rain cap. A "Critical Degree" silencer is considered to be one capable of attenuating engine exhaust noise component to 85 dba at 10 feet in a free-field environment. Note the overall sound attenuation specified in paragraph 1.14.

1.11 JACKET WATER HEATER

- A. A jacket water heater, thermostatically controlled, shall be installed on the engine. Heater shall be 1000 watts, 120 VAC single-phase input. Heater shall be mounted on the generator base rails and provided with flexible hoses to the engine. Flexible hoses shall be rated at 300 degrees F. and 100 PSI. Provision shall be made for isolation of the jacket water heater with 3/4 inch NPT ball-valves installed at the engine side of the flexible hoses. Provide a disconnect safety switch, or disconnect plug, to isolate the heating element from the electrical source for maintenance purposes.

1.12 FUEL STORAGE SYSTEM

- A. Provide a sub-base mounted fuel storage tank which when filled to 90% is capable of supporting the generator set without refilling at rated load for 37 hours. Base tank shall provide a 13 inch long area for access for electrical conduit from below. Provide a removable end plate for access to the cable entry area. Tank shall be built and labeled in accordance with UL-142. Mounting feet shall provide clearance between bottom of tank and foundation.
- B. Tank features shall include:
1. 2 inch filler neck and locking cap
 2. Engine supply and return openings and draw tubes
 3. Emergency vents per NFPA 30 for both primary and secondary containment with approved caps. Normal tank vent shall be extended to a height of 12 feet above the tank level.
 4. Tank leak port
 5. Fuel level indicator gauge, direct reading type
 6. Low fuel level alarm switch, set at 50% remaining capacity, wired to the generator controller.
 7. Secondary containment, totally closed design, by double wall construction. Provide alarm contact for "liquid in containment basin." Wire contact to alarm light in the generator control panel.
 8. Lifting plates shall be provided at each mounting point. Note that lifting plates must be sufficient to permit lifting of the complete generator set assembly during installation.
 9. Provide a 5-gallon overspill containment basin to comply with State of California requirements for prevention of spill during a manual fill operation.
 10. High fuel level alarm switch, set at 90% full, wired to the generator controller and alarm horn.

1.13 REMOTE COMMUNICATION AND ANNUNCIATOR PANEL

- A. Remote Communication: Provide a single software package and Modbus/Ethernet converter to permit monitoring of the generator and ATS system from remote internet locations. Indication shall include:

Generator common fault
Generator power available
Utility power available
Low engine temperature
ATS in "normal" position
ATS in "emergency" position
ATS control switch not in "auto"
Pre alarm high engine temperature
High engine temperature shutdown
Pre alarm low oil pressure
Low oil pressure shutdown
Low water temperature
Battery charger fault
Low battery voltage
Auxiliary fault
(3) User input options
Low fuel level
Overspeed shutdown
Overcrank lockout

B. Remote Annunciator Panel: Provide and install a remote alarm/status panel as shown on the drawings. Annunciator shall meet the requirements of NFPA 110 for critical facilities and utilize Modbus® RTU industry standard open communication protocol. Panel shall include the following features:

1. Alarm indicators for:
 - a. Pre alarm high engine temperature
 - b. Pre alarm low oil pressure
 - c. Low water temperature
 - d. Battery charger fault
 - e. Low battery voltage
 - f. Auxiliary fault
 - g. (3) User input options.
2. Shutdown indicators for:
 - a. High engine temperature
 - b. Low oil pressure
 - c. Emergency stop
 - d. Overspeed
 - e. Overcrank
3. Status indicators for:
 - a. Line power
 - b. Generator power
 - c. System ready
 - d. Generator switch not in "auto"

- e. Lamp test switch
- 4. Alarm horn, with "Silence/Normal" switch.
- 5. Annunciator panel shall be arranged for either flush or surface mounting as shown on the drawings.

1.14 WEATHER PROTECTIVE AND SOUND ATTENUATED ENCLOSURE

- A. Provide a weather-protective and sound attenuated enclosure with removable and hinged doors to allow inspection and maintenance. Enclosure material shall be galvanized G60 steel alloy with a minimum thickness of 18 gauge. Lockable latches shall be of stainless steel. Doors shall have a common keyed latch. Provide two (2) sets of keys. Galvanized steel shall be prime painted with a urethane base coat and finish coats in the manufacturer's standard color enamel. Enclosure shall have successfully completed a 500-hour salt spray test done in compliance with ASTB-117.
- B. Enclosure and engine exhaust system shall be sound attenuated to limit noise level when operating at full load to a maximum of 68 dBA at 23 feet in any horizontal direction from the center of the unit. Intake and discharge of cooling air shall be through top mounted openings that are covered for weather protection. Provide acoustical material on internal walls and surfaces of the enclosure. External holes and openings in the enclosure shall be covered with galvanized or coated mesh to prevent entry of birds and rodents. Provide a trouble light inside the enclosure powered by 120 vac.

1.15 SEISMIC RESTRAINT AND CERTIFICATION

- A. Seismic restraint: The generator set shall be mounted on vibration isolators to the steel base assembly. The base assembly shall be anchored directly to the concrete foundation by means of approved anchor bolts. A minimum of four (4) anchors shall be provided by the generator set supplier.
Provide calculations signed by an engineer registered in the State of California verifying selection of the anchor bolts and compliance with California Administrative Code Title 24 for Zone 4. These calculations shall be a part of the submittal data provided.
- B. Seismic certification: Provide certification that the generator assembly and automatic transfer switch, in the configuration being installed, will withstand seismic forces. Include the following:
 - 1. Basis for certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. 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."
 - 2. Provide outline drawings of the equipment. Identify center of gravity and locate and describe mounting and anchorage provisions. Provide detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.16 AUTOMATIC TRANSFER SWITCH

- A. Provide an automatic transfer switch fully compatible with the engine generator control system. Switch shall be rated for continuous duty at 480/277 volts, three phase, 4 wire, 60 Hertz, and be sized as indicated on drawings. Switch shall contain 4 poles with switched neutral and shall be mounted in Nema 1 enclosure for indoor installation as shown on the drawings. The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load.
- B. Automatic transfer switch shall be Kohler model KCS, or equal by Zenith or Russelectric.
- C. Electrical Requirement
 - 1. Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.

2. The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. The switch shall be 240 volt class.
3. The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.
4. The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans. Minimum withstand/closing rating shall be 50,000 RMS symmetrical amperes when coordinated with the specific circuit breaker specified.

D. Mechanical Requirements

1. All main contacts shall be of silver composition. The main contacts shall be protected by arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration and of segmented construction in ratings 600 amperes and above.
2. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
3. The contact transfer time shall not exceed one-sixth of a second.

E. TRANSFER SWITCH CONTROL SYSTEM

1. The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.
2. The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.
3. The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:
Keypad pushbuttons:
 - a. Start/end system test
 - b. Set/end exercise
 - c. End time delay
 - d. Lamp test/service reset
4. Light-emitting diode status indicators:
 - a. Contactor Position: Normal, Off, Emergency
 - b. Source Available: Normal, Emergency
 - c. Service required: immediate, maintenance
 - d. Not in automatic mode
 - e. Four stage time delay remaining
 - f. Exercise: load, no load, set/disabled
 - g. Test: load, no load
 - h. Load control active: peak shave (remote test), load shed, pre/post-transfer signal

- i. In-phase monitor/Off delay active
- 5. Outputs:
 - a. Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.
 - b. Pre-transfer load control, one normally open contact rated 10 amps @30 250 VAC.
 - c. One programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

F. OPERATION

- 1. All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use have an anti-single phasing protection also that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition.
- 2. Voltage and frequency sensing:
 - a. Under voltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.
 - b. Under voltage dropout set at 90% of pick up voltage, adjustable 75%-98% of pickup voltage.
 - c. Over voltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.
 - d. Over voltage pick-up set at 95% of nominal voltage, adjustable 85% - 100% of nominal voltage.
 - e. Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.
 - f. Voltage accuracy: 2%.
 - g. Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.
 - h. Over frequency dropout set 101% of nominal frequency, adjustable 101% - 105% of nominal frequency.
 - i. Over frequency pick-up set at 110% of nominal frequency, adjustable 105%-120% of nominal frequency.
 - j. Frequency accuracy: .1%
- 3. TIME DELAYS:
 - a. Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.
 - b. Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.
 - c. Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.
 - d. Time delay for engine cool down: Range 0-60 minutes. Factory set at 0 minutes.
 - e. Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.
 - f. Pre-transfer to normal/emergency signal: Range 0-60 minutes. Factory set at 3 second.
 - g. Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 second.
 - h. Post-transfer to normal/emergency signal: Range 0-60 seconds. Factory set 0 minute.
 - i. Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.

4. User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.
5. The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.
 - a. Phase rotation sensing programmable ABC or CBA.
 - b. In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED or other signal on the user interface panel shall indicate active in-phase monitoring.
 - c. Plant Exerciser: Programmable seven-day or fourteen-day exerciser with user selectable load or no-load operation. A message on display, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. An amber LED shall flash on the user interface if the exerciser has been disabled.
 - d. The exerciser shall have the capability of being programmed, using up to twenty-one (21) events for a calendar mode. The controller shall have optional provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.
 - e. The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.
 - f. The control module must be upgradeable with four programmable input/output (I/O) modules with two inputs and six outputs each rated 2 amps @ 30VDC/250VAC.

G. MONITORING, PROGRAMMING AND COMMUNICATIONS:

1. Modbus® interface:
 - a. Industry standard Modbus® RTU communication shall be available with network and setup connections.
 - b. A Modbus® master will be able to monitor controller data.
 - c. A Modbus® master will be able to alter parameters.
 - d. The Modbus® master must be capable of starting and stopping the generator.
 - e. The manufacturer shall provide a Modbus® communications protocol manual to facilitate communications with a Modbus® master by a third party developer.
 - f. The Modbus® network shall communicate to the controller using a twisted pair of wire.
2. Personal Computer Set-up/monitoring Software
 - a. The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows 7 or Windows 10 through an RS-232 communication format (in addition to the Modbus® connection).
 - b. The software shall be Windows® based
 - c. The programming capability shall be password protected.
 - d. It shall be possible to start the generator and transfer the loads to the generator.
 - e. Event monitoring shall be accessible using either a personal computer with the personal computer software or keypad to view the following:
 - 1) Historical data (total and resettable)
 - 2) Days in operation

- 3) Hours in standby
 - 4) Hours not in preferred
 - 5) Switch transfers
 - 6) Failure to transfer
 - 7) Transfers due to loss of preferred
 - 8) Start up date
 - 9) Last maintenance date
 - 10) Switch transfer count since last maintenance
 - 11) Transfer switch information
 - 12) ATS serial number
 - 13) Controller serial number
 - 14) Contactor serial number
 - 15) Load description
 - 16) Location
 - 17) Branch
 - 18) Network connection ID
 - 19) Baud rate
 - 20) Parity bit
 - 21) System events (time and date stamped) of the last 16 events which include all failures of the sources, transfer switch and all functions of the controller and contactor.
 - 22) Time delay active
 - 23) Line to line voltage
 - 24) System frequency
 - 25) Time delay active
 - 26) Time delay remaining
 - 27) System status
 - 28) Source available
 - 29) Contactor position
 - 30) Exerciser schedule, mode and time remaining on active exercise.
 - 31) Programmable features may be viewed, selected or adjusted as follows:
 - i. System voltage
 - ii. System frequency
 - iii. Single/three-phase operation
 - iv. Open/closed-transition operation
 - v. ABC or CBA phase rotation
 - vi. In-phase monitor
 - vii. Commit/no commit transfer mode
 - viii. User defined password
- f. Programmable inputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
- 1) End time delay input

- 2) Inhibit transfer
- 3) Low external battery fault
- 4) Peak shave/area protection input
- 5) Remote common fault
- 6) Remote test
- g. Programmable outputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
Auxiliary switch fault
 - 1) Common fault
 - 2) Contactor position
 - 3) Exercise active
 - 4) Failure to acquire standby source
 - 5) Failure to transfer fault
 - 6) Generator engine start
 - 7) Load bank control
 - 8) Loss of phase fault
 - 9) Low backup battery
 - 10) No in automatic mode
 - 11) Non-emergency transfer
 - 12) Over and undervoltage faults
 - 13) Over and under frequency faults
 - 14) Peak shave/area protection active
 - 15) Phase rotation error
 - 16) Modbus®-controlled relay outputs
 - 17) Source available
 - 18) Test active

H. SEISMIC RESTRAINT AND CERTIFICATION

1. Provide verification of IBC compliant seismic certification for the automatic transfer switch assembly being provided. Certification shall include the following"
 - a. Certificate of compliance
 - b. Seismic label on the automatic transfer switch
 - c. Seismic installation instructions

1.17 TESTING

- A. Design prototype test: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype test since the tests may be potentially damaging. Rather, similar design prototypes and reliability preproduction models, which will not be sold, shall be used for these tests. Upon request, the following certified test records shall be made available:
- B. Maximum power (kW).
 1. Maximum starting (kVA) at 30% instantaneous voltage dip.
 2. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.

3. Governor speed regulation under steady-state and transient conditions.
 4. Voltage regulation and generator transient response.
 5. Fuel consumption at no load, 1/4, 1/2, 3/4, and full load.
 6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 7. Three-phase line-to-line short circuit test.
 8. Alternator cooling air flow.
 9. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
 10. Endurance testing.
- C. Final production tests: Each generator set shall be factory tested under varying loads with guards and exhaust system in place. Upon request, arrangements to witness this test will be made or a certified test record will be sent prior to shipment. Tests shall include:
1. Single-step load pickup.
 2. Transient and steady-state governing.
 3. Safety shutdown.
 4. Voltage regulation.
 5. Rated power.
- D. Site tests: An installation check, start-up and rated load test shall be performed by the manufacturer's local representative. The owner's representative and consulting electrical engineer, regular operators and the maintenance staff shall be notified of the time and date of the site test. Coordinate test date with APCD/SCAQMD inspection to allow APCD/SCAQMD observation of full test load if necessary for permitting. The test shall include:
1. The initial startup of the engine-generator set shall be performed by a factory trained representative of the engine generator set manufacturer. He shall furnish and install the recommended engine lubricants and fill the cooling system with a 50% solution of ethylene glycol antifreeze in accordance with the engine manufacturer's recommendations. He shall be present during the load test specified, and at the conclusion of the test shall supply the owner's representative with two (2) complete sets of operation, maintenance, and parts manuals for all equipment. Under this section of the specification, he shall instruct the owner's personnel in the proper operating and maintenance procedures for all components of the standby power system.
 2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, etc.
 3. Start-up under test mode to check for exhaust leaks, path of exhaust gases, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
 4. Automatic start-up by means of simulated power outage to test remote automatic starting, transfer of load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charger level along with generator voltage, amperes, and frequency shall be monitored throughout the test:
 5. Load test system, utilizing contractor furnished resistive load bank, as follows:

1/2 hour	@	1/2 load
1/2 hour	@	3/4 load
2 hours	@	rated load
 6. Measure and record the transient frequency and voltage dip, and recovery time to steady state conditions, for the single step application of rated load. Verify compliance with the

governor and voltage regulator performance specified in paragraph 4.4 and 7.3. Recording instrument to be of the light beam or direct thermal array type (ink chart type not permitted).

7. Provide a certified copy of site test report showing compliance with specifications and approval of the installation for warranty purposes.
8. The supplier of the generator system shall provide all fuel for testing and shall re-fill the existing main fuel tank to the previous level when testing is completed.

1.18 ORIENTATION TRAINING

- A. Orientation training shall be provided by a manufacturer's representative in cooperation with the installation contractor and electrical engineer. Four (4) consecutive hours of site-specific training shall be provided to owner's specified employees after the completion of equipment testing and commissioning. Training shall include a review of equipment operation, documentation and site-specific design.

1.19 WARRANTY

- A. The equipment supplied under this section shall be covered by a single warranty against defects in material and workmanship for a period of five (5) years or 3000 hours of operation. Warranty shall provide for free replacement or repair of parts, including labor, for the 5 year (3000 hour) period. A warranty statement including these features shall be provided as part of the owner's manuals. Warranty shall be administered by the same company that supplied the equipment.

1.20 PREVENTIVE MAINTENANCE SERVICE

- A. Furnish service and maintenance of engine generator for two years from date of Substantial Completion.
- B. Generator supplier shall perform the following reliability inspections and maintenance services during regular business hours on a monthly basis during the term that this agreement remains in effect. Services shall be provided at no additional charge to owner for the first two years beginning with final acceptance of the installation. Extension of the agreement for additional years shall be offered by the generator set supplier and shall be at the option of owner.
- C. Quarterly reliability inspections will include:
 1. Inspect overall appearance and condition of the generator set installation, enclosure, fuel storage, etc.
 2. Batteries will be cleaned, electrolyte levels and specific gravity will be checked, and reports made of any action necessary for recharging or replacing.
 3. Fuel tank and lines will be inspected for defects. Examine fuel tank pit for existence of liquid. Identify any liquid found and determine the source. Critical fuel levels will be noted and recommendations for refueling will be made when necessary.
 4. Fuel will be tested for evidence of water contamination. Fuel will be treated every 6 months to help prevent contamination. See "Additional Services for Annual Laboratory Fuel Analysis."
 5. Equipment will be checked for fuel, oil or coolant leaks.
 6. Fuel injection and governor system will be checked for proper operation.
 7. All fluid levels will be checked and topped-off as necessary. (Fuel not included)
 8. Air cleaners will be checked and if necessary recommendations made for replacement.
 9. Coolant test will be performed and customer advised of any problems with the cooling system.

10. Owners/operators present will be instructed on operating and upkeep procedures to follow between regular calls by service personnel.
11. Engine block heater and associated plumbing will be checked for proper operation.
12. All belts and cooling system hoses will be checked. Owner will be advised of their condition.
13. Check electrical connections and wiring for any abrasion or chaffing.
- D. After all of the above monthly inspections have been completed; service personnel will run equipment, record all operational gauges, check voltage and frequency outputs and engine electrical and mechanical shutdowns.
 1. All instruments will be checked for proper operation.
 2. Equipment will be checked for abnormal vibration and noises.
 3. Service personnel will conduct test under building load, simulating a commercial power failure, providing owner makes such load available and it is practical to run the test concerned.
 4. Automatic transfer switch will be inspected; all moving parts will be checked and cleaned if possible. Note: Automatic transfer switches are to be serviced annually.
- E. Technician will clean equipment and paint, if necessary, to prevent corrosion and preserve reasonable overall appearance.
- F. Report condition of system and, if discrepancies are found, provide a proposal for repairs to insure the stand-by reliability of the equipment.
- G. Annual Maintenance Services (once per year) will include the following:
 1. Perform reliability inspections as noted above.
 2. Change engine lubricating oil and oil filters.
 3. Change engine fuel filters.
 4. Change air cleaner element.
 5. Change water filters when used.
 6. Take oil sample and coolant sample for analysis by fluid testing laboratories.
 7. Perform a 4-hour resistive load bank test at 100% rated load.
 8. Service the automatic transfer switch
 9. Dispose of hazardous waste from service in accordance with all legal requirements including the maintenance of records regarding disposal.
- H. If there are any problems encountered during the planned maintenance service visit they will be brought to the attention of the owner/operator. Repairs will only be made after proper authorization from owner/operator is given to the technician. Labor will be billed at reduced special contract labor rates depending upon when the service is to be performed.
- I. Service organization shall provide proof of the following insurance coverage by furnishing a certificate naming the Owner as additional insured.
 1. Commercial general liability (occurrence basis)
 2. \$1,000,000 each occurrence
 3. \$1,000,000 personal and injury
 4. \$2,000,000 general aggregate
 5. \$2,000,000 products
 6. Automobile liability (any auto)
 7. \$1,000,000 combined single limit

8. Umbrella liability (occurrence basis)
 9. \$10,000,000 each occurrence
 10. \$10,000,000 aggregate
 11. Workers Compensation and employers' liability
 12. \$1,000,000 each accident
 13. \$1,000,000 disease each employee
 14. \$1,000,000 disease policy limit
 15. Inland Marine
 16. \$2,000,000
 17. Pollution liability
 18. \$2,000,000
- J. Service organization shall provide emergency contact information for 24/7/365 emergency response. Service technicians utilized for this site shall be trained in HazMat procedures and certified by the U S Department of Transportation for transportation of hazardous materials. All hazardous materials delivered to the site, or removed from the site, shall be documented and disposed of in accordance with DOT regulations.

END OF SECTION

**SECTION 26 5100
INTERIOR LUMINAIRES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Interior luminaires and accessories.

1.02 REFERENCES

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2014.
- C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- D. NECA/IESNA 500 - Recommended Practice for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- E. NECA/IESNA 502 - Recommended Practice for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- F. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011.
- H. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2006.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Instructions for each product.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.01 LUMINAIRES**

- A. Furnish products as indicated in Schedule included on the Drawings.
- B. Substitutions: See Section 01600 - Product Requirements.

2.02 LAMPS

- A. Manufacturers:
 - 1. GE Lighting: www.gelighting.com.
 - 2. Philips Lighting Co of NA: www.lighting.philips.com.

3. Substitutions: See Section 01600 - Product Requirements.

B. Lamp Types: As specified for each luminaire.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 and 502.
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Support luminaires larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- F. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.
- G. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.
- H. Install recessed luminaires to permit removal from below.
- I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- J. Install clips to secure recessed grid-supported luminaires in place.
- K. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.
- L. Install accessories furnished with each luminaire.
- M. Connect luminaires, emergency lighting units, and exit signs to branch circuit outlets provided under Section 26 05 33.
- N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- O. Bond products and metal accessories to branch circuit equipment grounding conductor.
- P. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01400.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

- A. Aim and adjust luminaires as directed.
- B. Position exit sign directional arrows as indicated.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.05 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate luminaire operation for minimum of two hours.

3.06 PROTECTION

- A. Relamp luminaires that have failed lamps at Substantial Completion.

END OF SECTION

NOT FOR BID

**SECTION 26 5600
EXTERIOR LUMINAIRES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires and accessories.
- B. Poles.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete: Foundations for poles.

1.03 REFERENCES

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- B. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000 (ANSI/IES RP8).
- C. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.
- D. Test Reports: Indicate measured illumination levels.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- F. Maintenance Data: For each luminaire.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Electrical Components: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle solid wood poles in accordance with ANSI O5.1.

1.07 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 PRODUCTS

2.01 LUMINAIRES

- A. Furnish products as indicated in Schedule included on the Drawings.
- B. Substitutions: See Section 01600 - Product Requirements.

2.02 POLES

- A. Manufacturers:
 - 1. Furnish products as indicated on the drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 501.
- B. Provide concrete bases for lighting poles at locations indicated, in accordance with Section 03300.
- C. Install poles plumb.
 - 1. Provide double nuts to adjust plumb.
 - 2. Grout around each base.
- D. Install lamps in each luminaire.
- E. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01400.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Measure illumination levels to verify conformance with performance requirements. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.03 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.05 PROTECTION OF FINISHED WORK

- A. Relamp luminaires which have failed lamps at Substantial Completion.

END OF SECTION

SECTION 27 1300
COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the Uniform General Conditions for Construction Contracts, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.

1.02 SUMMARY

- A. Section Includes:
 - 1. Coordination with other trades and parts of the Contract.
 - 2. Submittals.
 - 3. Quality Assurance.
 - 4. Parts and Manufacturers.
 - 5. Installation and Testing.
- B. The building backbone riser system connects Network Facilities to each other, to the Main Service Entrance Room, and to the Equipment Room. The Owner specifies separate cable systems to provide data, video and voice needs. The backbone riser system consists of plenum-rated, multi-pair twisted pair copper cables, coaxial, and single mode fiber cables along with associated termination systems. This Section covers labor, equipment, supplies, materials and testing involved in installing, terminating and labeling copper and fiber backbone infrastructure as described on the Drawings or required by these Specifications.

1.03 COORDINATION

- A. New cable plant requiring connection to, or disconnection from, networks is to be performed the Project Manager. networks include telephone, local and wide area, video, cable television, and fiber optic networks.
- B. Drawings in general are diagrammatic. It is the full responsibility of the Contractor to be familiar with the location of equipment involved under the work of other trades to eliminate conflicts between fiber and copper cable installation and the work of other trades.
- C. Direct questions and issues regarding IT coordination to the Project Manager.

1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the Submittal Administrative Requirements "Submittal Procedures." Use electronic format only.

1.05 ACTION SUBMITTALS

- A. Submit installation plan, and keep up-to-date throughout the Project, indicating:
 - 1. Equipment and personnel.
 - 2. Materials and staging area.
 - 3. Start and completion dates.
 - 4. Locations, including floor, room and building.

5. Installation plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal for review and approval by the UIT Project Manager.
- B. Submit copper cable pulling plan for all multi-pair copper cables with a pair count of 25 pairs or greater, that includes, but is not limited to, the following:
 1. Each cable run and route.
 2. Date and duration of the pull.
 3. Pulling methodology and equipment setups.
 4. Pulling tension calculations for each pull in the run.
 5. Safety issues and precautions to be taken.
- C. Submit cable pulling plan, as follows:
 1. Indicate the installed backbone conduit layout in schematic format, including junction boxes and distances between junction boxes.
 2. Indicate contents of each conduit.
 3. Indicate the cable pulling calculations, conduit fill ratios and actual cable runs and tensions.
 4. Cable pulling plan and calculations shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal for review and approval by the UIT Project Manager.
- D. Cable Splicing Submittals
 1. Fiber fusion splicing method and procedures.
 2. Schedules of copper and fiber cables to be spliced.
 3. Copper splicing method and procedures.
 4. Certification documents for all splicing personnel.
 5. Cut sheets of accurate locations of fiber and copper splice closures.
- E. Shop Drawing Submittals to include:
 1. Room penetration Drawing.
 2. Communications extension pathway Drawing.
 3. Riser conduit anchoring Drawing.
 4. Conduit chase Drawing.
 5. Communications pathway Drawing.
 6. Junction box, gutter and pull box labeling Drawing.
 7. Cabinet / rack elevation Drawing.
 8. Floor plan for all NF rooms.
 9. Wall elevation Drawings for all NF rooms.
- F. Manufacturer's data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment.
- G. Submit cable inventory data for all fiber, copper, and coaxial cabling and termination equipment. Submit data in Microsoft Excel format (current version), listing products furnished, including:
 1. Manufacturer's name.
 2. Manufacturer's part numbers and com code numbers.
 3. Cable numbers as described in Section 27 0553 "Identification for Communications Systems."
 4. Location and riser assignments.

5. Installed lengths for all fibers.
6. This requirement applies to copper cable, fiber optic cable, and all termination equipment.
- H. Product data for all termination and test equipment to be used by Contractor to perform work.
 1. Calibrate equipment with traceability to National Institute of Standards and Technology (NIST) requirements.
 2. Include a copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.
 3. Test equipment data shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal for review and approval by the UIT Project Manager.

1.06 INFORMATIONAL SUBMITTALS – Not Used

1.07 QUALITY ASSURANCE

A. Verification

1. Verify that the installation and material used has been inspected by the UIT Project Manager before it is enclosed within building features, or otherwise hidden from view. Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected.

B. Equipment

1. Use equipment and rigs designed for pulling, placement and termination of multi-pair copper and fiber optic cabling ; including reel trucks, mechanical mules, sheaves, shoes, anchors etc., and equipment for drilling masonry, installing anchors, etc., to install support and cable management hardware.

PART 2 PRODUCTS

2.01 PARTS AND MANUFACTURERS

- A. Refer to Section 01 2500 "Substitution Procedures" for variations from approved manufacturers or parts. Obtain prior written approval for substitutions from both the Owner's Project Manager and the UIT Project Manager.
- B. Backbone Cables
 1. Superior Essex
 - a. Part Number: 109-097-02 or 09-034-02 - Solid Copper Backbone/Tie Copper Cable: 24 AWG, UTP, Category 3, OSP Backbone Cables with an overall metallic shield.
- C. Protector Panels
 1. Circa Enterprises
 - a. Entrance Terminals: 188OECA1-100G
 - b. Protector Modules: Gas Protector Unit - 3BIE
- D. Copper Termination Hardware (Cat 3, legacy applications) – Main Cross Connect (MC)
 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR
- E. Copper Termination Hardware (Cat 3, legacy applications) – Building Distribution Frame (BDF)
 1. Panduit

- a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
- 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR
- F. Angled Patch Panels (Cat 3, legacy applications) – Equipment and IDF – 48-port, filled and terminated with appropriate number of black RJ-45 jacks.
 - 1. Panduit - UICMPPA48BLY
 - 2. CommScope - 760207308
- G. Copper Termination Hardware (Cat 6) – Main Cross Connect (MC)
 - 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 - 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR
- H. Copper Termination Hardware (Cat 6) – Building Distribution Frame (BDF)
 - 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 - 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR
- I. Angled Patch Panels (Cat 6) – Equipment and IDF – 48-port, filled and terminated with appropriate number of black RJ-45 jacks.
 - 1. Panduit - UICMPPA48BLY
 - 2. CommScope - 760207308
- J. Fabric Inner-duct
 - 1. MaxCell
- K. Metallic Tone Tape
 - 1. Arnco
 - a. DL WP12LC Tone Tape
- L. Outside Plant Fiber Optic Cable
 - 1. CommScope
 - a. 144-strand 9/125-micron single-mode outside plant rated fiber optic cable
 - b. 48-strand 9/125-micron single-mode outside plant rated fiber optic cable
 - c. 12-strand 62.5/125-micron multimode outside plant rated fiber optic cable (MM OSP cable shall be used only for fire alarm systems on the main campus; all other applications, including UH Technology Bridge fire alarm system, shall use SM OSP cable)
 - d. Powered fiber cable, single-mode (OS2), 4 fibers, indoor/outdoor, 12 AWG conductor: PFC-3014L12
 - 2. Corning

- a. 144-strand 9/125-micron single-mode outside plant rated fiber optic cable
 - b. 48-strand 9/125-micron single-mode outside plant rated fiber optic cable
 - c. 12-strand 62.5/125-micron multimode outside plant rated fiber optic cable (MM OSP cable shall be used only for fire alarm systems on the main campus; all other applications, including UH Technology Bridge fire alarm system, shall use SM OSP cable)
- M. Inside Plant Fiber Optic Cable
- 1. CommScope
 - a. 24-strand Plenum-rated 9/125-micron single-mode fiber optic cable
 - b. 12-strand Plenum-rated 9/125-micron single-mode fiber optic cable
 - c. 6-strand Plenum-rated 62.5/125-micron multi-mode fiber optic cable
 - 2. Corning
 - a. 24-strand Plenum-rated 9/125-micron single-mode fiber optic cable
 - b. 12-strand Plenum-rated 9/125-micron single-mode fiber optic cable
 - c. 6-strand Plenum-rated 62.5/125-micron multi-mode fiber optic cable
- N. Fiber Termination Hardware
- 1. Rack-mounted Fiber Distribution Units
 - a. CommScope
 - 1) For ER: #SD-4U
 - 2) For NFs: #SD-2U
 - 3) For Powered Fiber Cable: #RFE-SLG-EMT/1U
 - b. Corning
 - 1) For ER: #CCH-04U
 - 2) For NFs: #CCH-02U
 - 2. Use LC fiber connectors, except in the case of fire alarm systems using multimode fiber optic cable, which require ST fiber connectors.
- O. Firestopping Materials
- 1. Basis of Design Product: Specified Technologies EZ-Path firestop pathways.
 - 2. Comply with requirements of Section 07 8413 "Penetration Firestopping."

PART 3 EXECUTION

3.01 CABLE INSTALLATION – OUTSIDE PLANT

- A. Communications conduits shall be the top tier utility within the duct bank with a minimum of 18-inch separation from high voltage cabling.
- B. All fiber optic cable with loose tube construction installed underground shall be gel filled or constructed of appropriate waterproofing compounds.
- C. Fiber optic cable installed in manholes between buildings shall have a minimum of two (2) complete loops of at least 50 feet in each manhole.
- D. A copper tracer line shall be run with all fiber that is in a non-metallic conduit. In each conduit, install a pull cord having a metallic member (tone tape) with a minimum test rating of 200 pounds pulling strength. Secure all pull cords to prevent accidental removal.
- E. Fiber optic cables shall have minimum 20-foot service loops at the terminating ends and all approved splice points. Place service loops with large bend radii neatly bundled on walls or attached to the bottom side of ladder trays in 'figure-8' configuration.
- F. Install cable runs in one continuous length from bulkhead connector to bulkhead connector without splices, unless given a specific directive otherwise in the Drawings.

- G. Place all newly installed fiber optic cable inside fiber optic inner duct with one-inch inside diameter when not in conduit or utility tunnel cable tray.
- H. When splicing into the Metro fiber ring, all fiber cable installations shall be 100 percent terminated except as directed by the UIT Project Manager.
- I. Install plastic dust caps on all unused fiber terminations.
- J. Single-mode cable attenuation at 1310nm shall not exceed 1 dB plus 0.0008 dB per foot, end to end.
- K. The average/maximum fiber splice loss shall be 0.05/0.3 dB for single-mode fusion splices and 0.10/0.3 dB for mechanical splices.
- L. Include two fiber optic cables in each elevator umbilical.
- M. Install shield bond connectors to the shields of all cables terminated at the Protector Panels.
- N. Voice backbone cables installed in underground conduits or a tunnel shall be gel-filled PIC cable to a termination point within the ER. The backbone cable shall then be cross-connected to the protector blocks.
- O. Apply an appropriate amount of damming compound over the end of filled copper cables in indoor or dry environments to prevent seepage of cable filling compounds where encapsulant cannot be used.
- P. Prior to closure assembly in dry or indoor installations, all exposed cable pairs shall have the filling compound thoroughly cleaned off the cable insulation using appropriate cleaning solvents.
- Q. All splice cases used in the multi-pair voice backbone shall be waterproof.
- R. Test all spliced pairs and clear all splice-related faults prior to sealing the closure
- S. Voice backbone cables shall have a minimum 10-foot service loop when terminated in the NF and at any splice points in telecommunications manholes.
- T. Submit preliminary fiber test results to the UIT Project Manager after installation and before being put into service to provide for correction of any non-conformities or inconsistencies and to avoid disruptions to the active network.

3.02 BACKBONE CABLE TESTING

- A. Provide end-to-end test results for all copper UTP and fiber optic lines.
- B. All fiber optic cable shall be visually inspected and optically tested on the reel upon delivery to the installation site. Test all fibers for continuity and attenuation using Optical Loss Test Sets (OLTS) or an Optical Time Domain Reflectometer (OTDR), an access jumper with like fiber, a pigtail, and a mechanical splice.
- C. After installation, provide end-to-end (bi-directional) test measurements for single-mode and multimode fibers (2 wavelengths per test are required). Test results shall be submitted for review as part of installation inspection requirements.
- D. Test all fibers in the completed end-to-end system, following the technical criteria and formulae in the applicable section of ANSI/TIA-568-x-D. Note however, that all fiber shall be tested, rated and guaranteed for Ethernet GigaSPEED 1000B-X performance. Additionally, all fiber optic cable links shall pass all installation and performance tests both recommended and mandated by the cable manufacturer.
- E. All multi-pair copper cable pairs installed shall be tested to ANSI/TIA-568-x-D, Category 3 or Category 6 equivalent performance specifications using level IIe or higher field testers. In addition, provide loop resistance measurements in ohms and dB loss at 1 KHz, 8 KHz, and 256 KHz.
 - 1. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct any reversed or grounded pairs. Examine open and shorted pairs to determine if

problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

2. If copper cables contain more than the number of bad pairs shown in the table below, or if outer sheath damage is the cause of bad pairs, remove and replace the entire cable.

MAXIMUM PERMISSIBLE BAD PAIRS IN CAT 3 CABLING

CABLE SIZE	MAXIMUM BAD PAIRS

<100	1

101 to 300	1 – 3

301 to 600	3 – 6

>601	6

- F. Notify Owner's Project Manager and UIT Project Manager at least 24 hours prior to testing to allow observation at Owner's discretion. If Owner confirms intention to observe, agree with UIT Project Manager upon a reasonable starting time. Should UIT Project Manager not be present at the scheduled commencement time, Contractor may begin testing as scheduled.
- G. Format: Submit test results in two (2) formats: first, original file(s) downloaded from tester; second, data in Excel format with the following fields: NF RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.
- H. All test results shall be recorded and submitted to Owner for checking within 10 business days of cable installation.

3.03 CABLE AND TERMINATION PANEL LABELING

- A. Label the installed cables in accordance with Section 27 0553 "Identification for Communications Systems."

3.04 CABLE SUPPORT

- A. Provide cable supports and clamps to attach cables to backboards and walls.
 1. Attach horizontal and vertical backbone cables at 2-foot intervals using Owner-approved supports such as D-rings or jumper troughs utilized for wire management.
- B. Attach cables to manhole racks using Owner-approved methods.

3.05 CLOSE-OUT DOCUMENTS

- A. Red Line Drawings: Contractor shall keep one set of floor plans at the Project Site during working hours with installation progress marked and backbone cable labels noted. Red line drawings are required to be available for examination during construction meetings and field inspections.
- B. As-Built Drawings:
 1. Provide files in .dwg, .rvt and .pdf formats showing floor plans with room numbers and final backbone cabling and pathway locations and labeling.
 2. Submit within 5 business days of final cable testing.
 3. Include GPS coordinates of all manhole/pull boxes.

END OF SECTION

SECTION 27 2000
DATA AND VOICE INFRASTRUCTURE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.
- B. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 20 00 includes, but is not limited to the sections identified in Section 27 00 00.

1.02 SCOPE

- A. The Installing Contractor shall furnish and install all materials to extend the owners existing Telecommunications Infrastructure system in accordance with this specification and the contract drawings. The system shall be in full compliance with a "Limited Lifetime Warranty". The Installing Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.
- B. The installation shall include Fiber Optic Cable and Copper Category Rated Cables, interconnect equipment, connectors, jumpers punch blocks, fiber optic patch panels, copper patch panels, patch cables, telecommunication outlets, wire management..
- C. The Installing Contractor is required to coordinate with the Owner so that the telephone system can be patched into the Data and Voice infrastructure by the Installing Contractor.
- D. All copper Horizontal Cables shall be terminated on patch panels in the Telecommunication Rooms (MDF and designated IDF locations) and on Telecommunications Outlets.
- E. Upon completion of installation, the Installing Contractor shall test all fiber and copper cables. All cables shall be tested as defined elsewhere within this specification.
- F. The work under this specification shall be of good quality and completed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- G. The system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 "Testing & Complete System Functionality", prior to "Substantial Completion".
- H. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 20 00 includes, but is not limited to the sections identified in Section 27 00 00.
- I. See "Horizontal Cable" and "Racks" located in this specification for additional work and equipment. This includes, but is not limited to; CAT6 Cabling for ALL Local Area Network (LAN) based Systems as shown on the plans, detail sheets, and riser diagrams.

1.03 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work specified in this Section.
- B. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:
 - 1. BICSI Information Technology Systems Installation Methods Manual, 6th Edition
 - 2. BICSI Telecommunications Distribution Methods Manual, 13th Edition
 - 3. ANSI/TIA 606-A (2002) Administration Standard for Commercial Telecommunications Infrastructure.

4. ANSI/TIA 607-B Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA 455 61 (latest edition). "FOTP 61, Measurement of Fiber or Cable Attenuation Using An OTDR".
6. TIA-526-7. Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant OFSTP-7.
7. ANSI/TIA 568 C.0. "Generic Telecommunications Cabling for Customer Premises."
8. ANSI/TIA 568 C.1. "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements."
9. ANSI/TIA 568 C.2. "Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components."
10. ANSI/TIA 568 C.3. "Optical Fiber Cabling Components Standard."
11. EIA/TIA 569-B. "Commercial Building Standard for Telecommunications Pathways and Spaces."
12. IEEE 802.3 (latest edition) "Carrier Sense Multiple Access With Collision Detection."
13. International Building Code (latest edition).
14. International Fire Code (latest edition).
15. NEC (National Electrical Code) (latest edition).
16. Telecommunications Architectural Standards In Washington State Government (latest edition).

1.04 QUALITY ASSURANCE

A. Installing Contractor Qualifications:

1. The Installing Contractor project manager shall hold a valid and current Registered Communications Distribution Designer (RCDD) certification issued by Building Industry Consulting Service International (BICSI). The project manager shall have a minimum of five years' experience with projects of similar size and scope.
2. The Installing Contractor field staff installers shall hold valid and current Installation certifications issued by Building Industry Consulting Service International (BICSI) or hold documented certification of training from the manufacturer of the cabling and equipment that is being installed. The field staff shall have a minimum of five years' experience with projects of similar size and scope.
3. The Installing Contractor shall be an Authorized Premier Network Installer Certification Only Partner of the Manufacturer of the equipment being installed and shall furnish documentation showing that the Installing Contractor is trained and certified. The Installing Contractor shall be capable of providing the Owner with a documented Limited Lifetime Performance Warranty of the equipment being installed at the time of project bid, to be approved for bidding.
4. Work in this section shall be performed by a licensed and bonded low voltage Installing Contractor with a minimum of five years' experience in the installation and maintenance of high speed data and voice networks. Only Installing Contractors whose primary business is that of installing, maintaining, troubleshooting, and testing Telecommunication Infrastructures shall perform this work.
5. In order to qualify for installation of the Telecommunications Infrastructure Installing Contractor must possess the required license classification, a performance history, experience in the installation and termination of copper and optical fiber cable systems, and proof of time in business.
6. License Classification: Installing Contractor must possess a valid Washington State 06 Electrical Low Voltage License.

1.05 GOVERNING CODES AND CONFLICTS

- A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.06 PROJECT CONDITIONS ARCHITECTURAL PLANS

- A. The Installing Contractor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

1.07 SUBMITTALS

- A. Refer to specification 27 00 00 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. See Section 27 00 00 Low Voltage Systems General Requirements for additional requirements.
- B. The Installing Contractor shall review the Site Plans, Floor Plans, Riser Diagrams, and Detail Sheets for additional work that is required to be performed by the Installing Contractor of this section.
- C. Leviton / Berk-Tek manufactures the products that are used for the basis of design of this specification.
 - 1. Equivalent manufacture's solutions may be submitted for prior approval no less than 2 weeks before bid date closing. Products not submitted for prior approval shall be rejected.
 - a. Include with substitution request, a 3rd party verified testing agency's report which shall include, but not be limited to, the following TIA-568-C.2 tests:
 - 1) Insertion Loss / Attenuation.
 - 2) NEXT (Near End Cross Talk).
 - 3) PSNEXT (Power Sum Near End Cross Talk).
 - 4) ACR (Attenuation Crosstalk Ratio).
 - 5) PSACR (Power Sum Attenuation Crosstalk Ratio).
 - 6) ACR-F (Attenuation Crosstalk Ratio – Far End)
 - 7) PSACR-F (Power Sum Attenuation Crosstalk Ratio – Far End)
 - 8) The following tests are only required for CAT6A cabling:
 - a) PSANEXT (Power Sum Alien NEXT)
 - b) PSAACRF (Power Sum Alien ACRF)
- D. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All Telecommunications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:
 - 1. CMR General Purpose Communications Riser Cable.
 - 2. CMP Plenum rated Communications Cable.
 - 3. And other cable ratings to comply with the National Electrical Code requirements for the installation.
- E. All products shall meet the certification requirements of the warranty. All device products and all cabling products shall be of a single manufacturer.
- F. Provide all equipment as defined in the specification(s) and shown on the drawings.

G. Refer to PART 1 for any equipment that is not specifically defined.

2.02 COORDINATION

A. Refer to "Installation of Owner Furnished Equipment" for additional coordination and installation requirements.

B. Refer to "Submittals" for additional coordination requirements.

2.03 INSTALLATION OF OWNER FURNISHED EQUIPMENT

A. The Installing Contractor shall install the following Owner Furnished equipment:

1. Wireless Access Points (WAP's). Coordinate with the Owner as required.

a. Install each WAP where indicated on the plans.

2.04 ADDITIONAL REQUIREMENTS.

A. Refer to "As-Built Drawings" listed elsewhere in this specification for additional equipment required for this project.

2.05 TELECOMMUNICATIONS SYSTEM DESCRIPTION

A. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or designated IDF location. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Legend, unless noted otherwise.

B. Horizontal cables are to be terminated on rack-mounted patch panels of the same data speed transfer rating. Horizontal Cabling shall be to Patch Panels within each designated rack. Horizontal Cabling shall be cross-connected to backbone cables.

C. A fiber optic backbone shall be installed between the Main Distribution Frame (MDF) and each designated Intermediate Distribution Frame (IDF) for data connectivity. Within the MDF and the IDF's, the backbone fiber strands shall be terminated and housed in rack-mounted fiber optic enclosures. Both ends of EACH fiber shall be terminated.

2.06 LABELING

A. See Section 27 00 00 for additional label type and additional requirements.

B. The alpha-numeric labeling shall be developed by the Installing Contractor, under the direction of the Owners IT Department at the Pre-Installation project kick-off meeting.

C. The Installing Contractor shall label all equipment and cables in an identical fashion of a sequential manner to the satisfaction of the Owner.

D. All label printing shall be machine generated using indelible ink ribbons or cartridges, and self-laminating labels shall be used on cable jackets appropriately sized to the outside diameter of the cable.

E. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

F. Patch panels shall have each port labeled to identify each outlet port.

G. Cable Identification Labels shall be placed in the following locations:

1. Horizontal Cables. Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel and placed within view.
2. Backbone Cables. Each cable shall be identified and marked on all backbone cables (at both ends of the cable) with an identifier as to the location of the beginning and termination of the each cable. Labels shall be attached to each cable at the point of entrance and exit to the MDF and each designated IDF location.

H. Where telecommunications outlets are located above accessible ceiling space, provide a label directly on the ceiling tile grid indicating "TELECOM OUTLET ABOVE".

2.07 TELECOMMUNICATION OUTLETS

- A. Review the Site Plan(s), Floor Plan(s), Riser Diagram(s), and Detail Sheet(s) for all cable types and quantities required for this project.
- B. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Electrical Legend, unless otherwise noted.
- C. Provide Horizontal Cabling from EACH Telecommunication Outlet port to the nearest MDF or designated IDF location.
- D. Telecommunication Outlet:
 - 1. Each Outlet shall accommodate individual modular ports and each modular port shall be individually removed without affecting any other port within the outlet.
 - 2. Coordinate the labeling requirements with the Owner's IT department.
 - a. Outlet label identification information shall be typed text and indicate patch panel and port for each jack and shall comply with the Owners Labeling Standards. Hand written information will not be acceptable.
 - 3. Surface Mount Outlet Locations shall only be installed above accessible ceiling spaces, the MDF Room, and designated IDF locations. They are not to be installed below the ceiling surface or exposed to view, unless approved in writing by the Owner.
 - a. Provide modular single-port or dual port Surface Mount Outlet where indicated on the Plans. This includes, but is not limited to:
 - 1). Wireless Access Points.
 - 2) CCTV Cameras.
 - 3) Access Control Panel.
 - b. 1-Port Surface Mount Telecommunication Outlet, where shown on the plans, shall be manufactured by Leviton: Model # 41089-1WP, or approved equal. Provide quantities as required.
 - c. 2-Port Surface Mount Telecommunication Outlet, where shown on the plans, shall be manufactured by Leviton: Model # 41089-2WP, or approved equal. Provide quantities as required.
- E. Modular Inserts:
 - 1. 8-position, 8-conductor (8P8C). Individual workstation port and patch panel port modules shall be Category 6 rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.
 - 2. 8-position, 8-conductor (8P8C). Individual Wireless Access port and patch panel port modules shall be Category 6A rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.
 - 3. EACH workstation port shall be Category 6 rated.
 - 4. Each Wireless Access port shall be Category 6A rated.
 - 5. Cables shall be wired in accordance with TIA/EIA-T568B, unless noted otherwise.
 - 6. Each individual insert shall be fully compatible with the Surface mount Telecommunications outlet provided.
 - a. The Installing Contractor shall match the color of the horizontal cabling as called out in this specification for each individual insert module.
 - b. Manufactured by Leviton: Model # 61110-R(X)6 Series for Category 6 applications, or approved equal for all workstation outlets. Provide quantities as required. (X) Indicates color.
 - c. Manufactured by Leviton: Model # 6110G-R(X)6 Series for Category 6A applications, or approved equal for all Wireless Access point outlets. Provide quantities as required. (X) Indicates color.

2.08 FIBER OPTIC CABLE

- A. See "Testing of Cables" listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.
- B. All cables shall be UL listed and suitable for indoor and outdoor installation. Provide other cable types where required by Code and the AHJ.
- C. EACH Cable installed shall be rated for the appropriate application, such as; Riser Rated, Plenum Rated, Wet Rated, etc.
- D. Single-Mode Fiber Optic Cable:
 - 1. Fiber optic cables shall be utilized for connectivity between areas as shown on the plans (where applicable).
 - 2. Fiber optic cables shall be 09/125 micron, graded index, tight buffer indoor/outdoor riser rated, unless otherwise noted.
- E. The Installing Contractor shall provide Single-Mode Fiber Optic Cable as shown on the plans.
- F. Attenuation shall be measured in accordance with EIA fiber optic test procedures (FOTP's) 46 or 53, 57 and 30. Information transmission capacity shall be measured in accordance with the following ETA FOTP's 51 or 30, 54 and 57. Submit all test results to the Owner for review and approval.
- G. All fiber optic cable shall be installed in inner-duct with no splices in the fiber unless noted otherwise.
- H. All Inside Plant (ISP) Cables shall be PLENUM rated unless noted otherwise.
- I. Provide a minimum of (1) 12-Strand Fiber Optic Cable to EACH location, unless noted otherwise.
- J. Provide the following cables as shown on the plans and where required to provide the connectivity of equipment listed in this specification.
 - 1. OS1 – Single-Mode Indoor/Outdoor Tight Buffer Fiber Optic Cable shall be manufactured by Berk-Tek: Model # PDR012-AB0707-I/O, or approved equal.

2.09 FIBER OPTIC CABLE TERMINATION HARDWARE

- A. Fiber Optic Connectors: Provide keyed, ceramic-tipped connector plugs for termination at each fiber optic LIU's. Single-mode Fiber Optic Cable.
- B. Light Interface Unit (LIU):
 - 1. MDF room and IDF room:
 - a. Provide rack-mount multi-capacity terminal that is capable of a minimum of 72 fiber strands in MDF locations and a minimum of 36 fiber strands in IDF locations.
 - b. Provide label holders and color-coded labels.
 - c. Manufactured by Leviton: Model # 5R2UM-S06, or approved equal in MDF locations and Leviton: Model # 5R1UM-F03 in IDF locations. Provide quantities as required. Provide all necessary appurtenances to terminate all fiber optic cables. This includes, but is not limited to:
 - 1) Provide fiber termination adapter panels for LC connectors.
 - a) Manufactured by Leviton: Model # 5F100-2LL, or approved equal. Provide quantities as required to terminate each multimode fiber routed to the MDF Room and Portable Distribution Center.
 - b) Provide blank cover(s) for each unused adapter panel's space manufactured by Leviton: Model # 5F100-PLT, or approved equal. Provide quantities as required.
 - 2. Portable Distribution Center:
 - a. Provided Wall-Mount Enclosure multi-capacity terminal that is capable of a minimum of 48 fiber strands.

- b. Provide label holders and color-coded labels.
- c. Manufactured by Leviton: Model # 5W310-00N, or approved equal. Provide quantities as required. Provide all necessary appurtenances to terminate all fiber optic cables. This includes, but is not limited to:
 - 1) Provide fiber termination adapter panels for LC connectors.
 - a) Manufactured by Leviton: Model # 5F100-2LL or approved equal. Provide quantities as required to terminate each multimode fiber routed to the MDF Room and EACH portable building.
 - b) Provide blank cover(s) for each unused adapter panel's space manufactured by Leviton: Model # 5F000-PLT, or approved equal. Provide quantities as required.
- 3. Portable Building Fiber Outlet:
 - a). Provide 1-Port Surface Mount Telecommunication Outlet, where shown on the plans, shall be manufactured by Leviton: Model # 41089-1WP, or approved equal. Provide quantities as required. Mount to Fire Treated Backboard in accessible ceiling space adjacent to the Flush Mounted Wall Bracket
 - b) Provide QuickPort Duplex LC Adapter, Blue, zirconia ceramic sleeve, blue manufactured by Leviton: Model # 41085-SLL, or approved equal. Provide quantities as required. Provide all necessary appurtenances to terminate all fiber optic cables.

2.10 PATCH CABLES – FIBER OPTIC

- A. Upon completion of the project, the Data and Voice Infrastructure Installing Contractor shall deliver the following Fiber Optic patch cables for the MDF and EACH designated Portable location to the owner, as identified below:
 - 1. EACH Portable Location shall have a Qty. of 3 – 3' (1 meter) Fiber Optic single-mode patch cords with Duplex LC connectors.
 - a. Provide Single Mode patch cords when Single Mode Fiber is shown on the Drawings.
 - 2. EACH MDF Data Rack shall have a Qty. of 1 – 6' (2 meters) Fiber Optic single-mode patch cords with Duplex LC connectors for Each Portable Location the MDF is serving.

2.11 HORIZONTAL CABLE – INSIDE PLANT (ISP)

- A. See "Testing of Cables" listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.
- B. EACH Cable installed shall be rated for the appropriate application, such as; Riser Rated, Plenum Rated, Wet Rated, etc.
- C. Provide Horizontal Cabling from each Telecommunication Outlet to the nearest MDF or the nearest designated IDF location.
- D. Cable color codes shall be as follows.
- E. All horizontal data cable shall be blue in color.
 - 1. All CCTV and IP Access Control cable shall be yellow in color.
 - 2. All Wireless Access Point cable shall be green in color.
- F. The work station Telecommunication Horizontal Cable shall be Category 6 rated, 4 pair, 23 AWG UTP, unless noted otherwise.
 - 1. Manufactured by Berk-Tek: Model # LANmark 1000 Series plenum rated cable for Category 6 applications, or approved equal.
- G. The Wireless Access Point Cable shall be Category 6A rated, 4pair, 23 AWG UTP, unless noted otherwise

1. Manufactured by Berk-Tek: Model # LANmark-10G Series plenum rated cable for Category 6A applications, or approved equal.

2.12 HORIZONTAL CABLE – OUTSIDE PLANT (OSP) & WET RATED LOCATIONS

- A. See “Testing of Cables” listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.
- B. Outside Plant (OSP) cables shall be used where conduits are routed below grade. Such as; slab on grade floor boxes, underground conduits to another building, where required by code, etc. All Outside Plant (OSP) cable extending within the building at a distance greater than 49 feet shall be run in conduit.
- C. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or the nearest designated IDF location.
- D. The Telecommunication Horizontal Cable shall be Category 6 rated, 4 pair, 23 AWG UTP, unless noted otherwise.
 1. Manufactured by Berk-Tek: Model # LANmark-6 OSP Series, or approved equal.

2.13 PATCH PANELS – COPPER

- A. All patch panels shall be located at the MDF and each designated IDF location. They shall be rack mounted unless specifically otherwise noted.
- B. Provide a minimum of 25 % spare patch panel jack capacity.
- C. Patch panels should be fully populated, avoiding blanks and empty ports (with the exception being the last patch panel in the series which may not be fully populated).
- D. All Category patch panels shall be tested and approved for Category wiring as specified to cable type, per TIA/EIA-568C; shall have, rear cable management bar and front labeling.
- E. Patch panels.
 1. The panel shall be field-configurable and shall accept a full range of modular connectors.
 2. Manufactured by Leviton: Model # 4S255-S48, or approved equal for 48-port applications.
 3. Manufactured by Leviton: Model # 4S255-S24, or approved equal for 24-port applications.

2.14 PATCH CABLES - COPPER

- A. The Patch Cables shall be Category 6 rated, 4 pair, 23 AWG UTP for all Category 6 systems and Category 6A rated, 4-pair, 23 AWG UTP for all Category 6A systems, unless noted otherwise. Provide (1) Patch Cable per telecommunications outlet jack and (1) Patch Cable per telecommunications patch panel port as described below.
- B. The outer cable jacket shall match the color selection of the Horizontal Cable Color identified in “Horizontal Cable”.
- C. Provide a minimum quantity of (1) 3’ equipment cord for EACH telecommunication jack at Each Wireless Access Point. (Leviton # 6210G-3(X), or approve equal. (X) Indicates color of equipment cord according to Horizontal Cable Color identified in “Horizontal Cable”.
- D. Provide a minimum quantity of (1) 3’ equipment cord for EACH telecommunications jack at systems related equipment such as CCTV and IP access control system. (Leviton # 62462-03(X), or approved equal. (X) Indicates color of equipment cord according to Horizontal Cable Color identified in “Horizontal Cable”.
- E. Upon completion of the project, the Data and Voice Infrastructure Installing Contractor shall deliver the following patch cables:

The following items shall apply **ONLY** to the MDF Room and designated IDF locations.

Item #	Cable Length	Color to be determined by horizontal System cabling.	Quantity of Patch Cables (provide the following percentage of patch cables based on the Total patch panel Ports provided for this project) Unless noted otherwise.		
				manufactured by	Model # X indicates color of patch cable
1	3'		20%	Leviton	(CAT6) 62460-03(X)
2	7'		60%	Leviton	(CAT6) 62460-07(X)
3	9'		20%	Leviton	(CAT6) 62460-09(X)
4	3'		100%	Leviton	(CAT6A) 6210G-3(X)

2.15 FLUSH MOUNTED WALL BRACKET

- A. Rack Mount all equipment that is capable of being Rack Mounted.
- B. Southwest Data Products is the basis of design for the Flush Mounted Wall Bracket used within the portable buildings.
- C. Equivalent manufacture's solutions may be submitted for prior approval no less than 2 weeks before bid date closing. Products not submitted for prior approval shall be rejected.
- D. Section 27 2000 shall provide ALL Flush Mounted Wall Brackets and related equipment, including but not limited to; Patch Panels, Patch Cords, Wire Management, Power Strip assemblies, etc. for ALL Local Area Network (LAN) bases Systems as shown on the site plans, floor plans, detail sheets, and riser diagrams.
- E. Wall Bracket:
 1. Flush Mount Wall Bracket:
 - a. The Bracket shall have the following features:
 - 1) Complies with 19" wide rack EIA-310-D standards.
 - 2). Bracket Depth: 4RU.
 - 3) Color: Black.
 - b. Installation:
 - 1) Secure EACH Bracket to Fire Treated Backboard using the manufacturer recommended installation method.
 - 2) Provide Fire Treated Backboard as required in portable building mounted above the accessible ceiling space.
 - c. Manufactured by Southwest Data Products: Model # SWE614 or approved equal.
 - F. Provide the quantities where shown on the drawings.

2.16 WIRE RINGS

- A. Cables on backboards shall be supported using open distribution rings. Rings shall be located within 12" of entering or exiting conduit, 6" prior to any radius bends and at least 12"

on center. The rings shall have rounded edges and be designed in a "C" configuration. Securely mount distribution rings to the plywood backboard.

- B. Chatsworth Products Inc. (CPI): Model # 12035-001, or approved equal. Provide quantities as required.

2.17 CABLE MANAGEMENT TIES

- A. Wire ties of any type shall NOT be used anywhere in this installation.
- B. Bundle all Horizontal Cables together with Velcro-type tie wraps.
 - 1. Adjustable Velcro Straps shall be used for all cable bundles.
 - a. Provide Velcro Straps every two-feet (approximately) above accessible ceilings, in Cable Trays (where applicable) and throughout the cable run.
 - b. Provide Velcro Straps every twelve-inches (approximately) within the MDF and each designated IDF location.
 - 2. Chatsworth Products Inc. (CPI): Model # 020XX-201, or approved equal. XX indicates actual length. "06" (6-inches long for two-inch diameter cable bundles), "09" (9-inches long for three-inch diameter cable bundles), and "12" (12-inches long for four-inch diameter cable bundles). Provide quantities as required.

2.18 ADDITIONAL SYSTEM EQUIPMENT

- A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 EXECUTION

3.01 GENERAL

- A. See Section 27 00 00 Low Voltage Systems General Requirements for additional information.
- B. Prior to rough-in, coordinate with the Owner for the exact location(s).
- C. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

3.02 PRODUCT INSPECTIONS

- A. The Installing Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted; un uniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

3.03 CABLE INSTALLATION GENERAL

- A. EACH CABLE RUN SHALL BE CONTINUOUS, WITHOUT ANY SPLICES, from the Telecommunications Outlet to the patch panel(s). Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.
- B. The Installing Contractor shall insure that EACH Telecommunications cable is installed with care, using techniques which prevent kinking, sharp bends, scraping cutting, deforming the jacket, or other damage. During inspection evidence of such damage will result in the material being declared unacceptable. The Installing Contractor shall replace unacceptable cabling at no additional cost to the Owner.
- C. Conduit and Raceway Usage: All Telecommunications cable shall be installed in grounded metal conduit or raceway dedicated for Telecommunications purposes, when called for on the Project Drawings, and not to be shared with electrical wiring.
- D. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.
- E. All wiring to be installed in a neat and inconspicuous manner and per local code requirements. Route wires parallel or perpendicular to the building structure using the specified cable supports. Wiring shall be installed near or on structural members as to

minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

- F. Cable Lubricants specifically designed for installing Telecommunications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.
- G. Backboard and Rack Cable Supports: Clamps, "D Rings", Velcro and tie wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable. Provide Fire Treated Backboard in portable buildings mounted above accessible ceiling space. Size as required to fit space to accommodate the Flush Mount Wall Bracket and Fiber Outlet.

3.04 HORIZONTAL CABLING

- A. Horizontal Cables shall be dressed and terminated in accordance with TIA/EIA-568-B requirements and the cable manufacturer's recommendations.
 - 1. Untwisting of pairs at the termination point shall not exceed one-half an inch for Category 6 connecting hardware.
 - 2. Bend radius of the cable in the termination area shall not be less than the manufacturer's recommendation.
 - 3. The Horizontal Cable jacket shall be maintained as close as possible to the termination point.
- B. Every attempt shall be made to avoid running Horizontal Cables close to (less than 24") and parallel to power raceway and wiring, or close to light fixtures.
- C. When an approved cable support is used to support cable bundles, all horizontal cables shall be supported at a maximum of four-foot intervals with UL approved cable support. At no point shall cables rest on acoustic ceiling grids or panels. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the Installing Contractor shall install clips to support the cabling.
- D. The installation of Horizontal Cables around moveable devices, instruments, subpanels, etc. shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.
- E. Pathways:
 - 1. It is the responsibility of the contractor to ensure that ALL PATHWAYS for the permanent link of each balanced twisted pair cable shall not exceed 295' in length from work area outlet to telecommunications room patch panel.
 - 2. To ensure this length, all pathways shall be coordinated and installed prior to pouring of any slabs or the installation of any permanent structure which would inhibit a conduit or cable tray run from being installed after the structure is complete.

3.05 PLYWOOD BACKBOARD CABLING

- A. Horizontal Cable installation must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining maximum distance from these openings.
- B. Horizontal Cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate backboard space is available for current and future equipment and for cable terminations. Horizontal Cables shall not be connected or attached to electrical conduit or other equipment. Minimum bend radius shall be observed.

- C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Velcro wrap all similar cables together and attached by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment or other cables.
- D. Horizontal Cables that are not dressed in a neat fashion, or with excessive slack, will not be accepted.

3.06 FIBER OPTIC BACKBONE CABLING

- A. Fiber optic termination hardware shall be installed in the following manner:
 - 1. Fiber slack shall be neatly coiled within the Light Interface Unit (LIU). No slack loops shall be allowed external to the LIU's, unless otherwise noted.
 - 2. Each cable shall be individually attached to the respective termination LIU by mechanical means. The cables strength member(s) shall be securely attached to the cable strain relief bracket in the LIU.
 - 3. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the LIU.
 - 4. Each cable shall be clearly labeled at the entrance to the LIU. Cables labeled within the bundle shall not be acceptable.
 - 5. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

3.07 CABLE LABELING

- A. Alpha-numeric numbering shall be developed by Installing Contractor, under the direction of the Owners IT Department. Label all equipment and cables in an identical fashion.
- B. Patch Panel Labeling: Each terminal shall be identified and marked on the patch panel with the outlet port identification.
- C. Outlet Port Labeling: Outlet labels for each port shall be identified and marked on the Outlet with the outlet port identification.
- D. Backbone Labels: Labels shall be identified and marked on all backbone cables (at both ends of the cable) with an identifier as to the location of the beginning and termination of the each cable. Labels shall be attached to each cable at the point of entrance and exit to the MDF and IDF Rooms.
- E. Horizontal Cables: Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel.

3.08 TESTING OF CABLES

- A. Notification shall be given a minimum of 14 days prior to any testing so that the testing may be witnessed by the Owner.
- B. An ETL certified, TIA-1152 Level IIIe (ISO/IEC 11801 Level IV) Test Meter shall be used to test all balanced twisted-pair coper cabling.
- C. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.
- D. Provide documentation of the following items of EACH Test Meter used:
 - 1. Calibration certification from a third party shall be within two-years of testing (at the time that the test is performed).
 - 2. Manufacturer of Test Meter.
 - 3. Model Number of Test Meter.
 - 4. Serial Number of Test Meter.

- E. Copper Cables – Category 6 and 6A Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Contractor shall test:
1. Wire Map.
 2. Length.
 3. Insertion Loss / Attenuation.
 4. NEXT (Near End Cross Talk).
 5. PS-NEXT (Power Sum Near End Cross Talk).
 6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
 7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
 8. Return Loss.
 9. Propagation Delay.
 10. Delay Skew.
 11. The following tests are only required for CAT6A cabling:
 - a. PSANEXT (Power Sum Alien NEXT)
 - b. PSAACRF (Power Sum Alien ACRF)
- F. Fiber Optic Cables – Single-Mode Inside Plant (ISP) and Outside Plant (OSP): Each of the fibers shall be tested from End-to-End. The Tests performed shall comply with ANSI/TIA-568-C.3 standards. The Installing Contractor shall test:
1. Polarity Testing
 2. Length Measurement.
 3. OLTS / Link Attenuation.
 4. OTDR.
 5. Two 2-meter patch cords shall be used for the actual test. The two jumper test shall be used to estimate the actual link loss of the installed cables plus the loss of the connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use.
- G. The source of each error shall be determined, corrected, and the cable re tested. All defective cables, connectors, connections, and related appurtenances shall be replaced and re tested at no additional cost to the Owner.
- H. Submit the Test Reports in PDF format.
- I. See the O & M Manual / Asbuilt Drawings requirements in this specification and also in Section 27 00 00 for additional requirements.
- J. Acceptance of these test procedures is predicated on the Installing Contractor's use of the recommended products including, but not limited to; the specified cable type, patch panels, outlets, punch blocks, specified equipment identified in Part 2 and the installation standards of this specification. Adherence to these requirements shall be determined upon the completed installation and will be evaluated in the context of each of these factors.

3.09 FIRE RATED PENETRATIONS

- A. Install per manufacturers recommendations.
- B. Maintain all Code and AHJ requirements.

3.10 WARRANTY

- A. Upon final installation, a certificate providing a "Performance and Application Warranty" shall be provided to the owner. This warranty shall be valid for a period of no less than Limited Lifetime. The warranty shall be direct to the end user, from the manufacturer, supported through the installing and certified Installing Contractor, and shall cover both materials and labor costs for any claims related to the warranty program. If the Installing Contractor were to

default, the manufacturer will assume responsibility of employing another certified installer to maintain the existing warranty. Bids from installers or Installing Contractors who are not certified by the connecting hardware manufacturer and wire manufacturer at the time of project bid, will be rejected.

3.11 OPERATION & MAINTENANCE MANUALS (O&M'S)

- A. Provide all Operation & Maintenance Manuals (O&M's) documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.
- B. Provide hard copies of the Test Results of EACH Cable tested.
- C. Provide the Test Results on CD in PDF format.

3.12 AS-BUILT DRAWINGS

- A. Provide all As-Built documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.
- B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.
- C. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.
- D. The Installing Contractor shall provide As-Built drawings to the Owner, which clearly indicates:
 - 1. The floor plan of the building showing the As-Built location of Telecommunication Outlets and their associated Port Address(es), conduit runs, and terminal cabinets.
 - 2. A list of EACH Telecommunication Outlet and the associated Port Address(es) shall clearly be identified according to system labeling scheme. Show all ports and punchdowns.
 - 3. Provide (3) sets of complete As-Built.

END OF SECTION

**SECTION 31 1000
SITE CLEARING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Clearing and protection of vegetation.
- B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

- A. Section 01 5713 - Temporary Erosion Control.
- B. Section 31 2200 - Grading: Topsoil removal.
- C. Section 31 2323 - Fill and Backfill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 PROJECT CONDITIONS

- A. Conform to applicable regulations relating to environmental requirements, disposal of debris and use of herbicides.
- B. Coordinate clearing work with utility companies.
- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

PART 2 PRODUCTS**2.01 -- NOT APPLICABLE --****PART 3 EXECUTION****3.01 PREPARATION**

- A. Locate and identify utilities to remain.
- B. Verify existing plants designated to remain are tagged or identified.

3.02 PROTECTION

- A. Tag existing plants designated to remain.
- B. Protect utilities that remain from damage. All existing utilities to remain should be located and flagged.
- C. Protect trees, plant growth, and features designated to remain as final landscaping.
- D. Protect bench marks and lot corner monumentation from damage or displacement.

3.03 SITE CLEARING

- A. Comply with other requirements specified in Section 01 7000 - "Execution Requirements".
- B. Clear areas required for access to site and execution of work.
- C. Minimize production of dust due to clearing operations; do not use water if that will result in flooding, sedimentation of public waterways or storm sewers, or other pollution.
- D. Remove trees, shrubs and stumps indicated. All excavation should be conducted in a manner not to cause loss of bearing and/or lateral support of existing structures or utilities.
- E. Clear surface vegetation, undergrowth and deadwood without disturbing subsoil.
- F. Remove surficial soils containing roots and perishable materials.
- G. Abandoned underground utilities lines should be traced out and completely removed. Cap ends as indicated on Civil Demolition drawings.

3.04 DEBRIS

- A. Remove existing loose soil, vegetation, debris and other unsuitable materials for all building, slab and pavement areas and all other graded surfaces.

- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

NOT FOR BID

**SECTION 31 2200
GRADING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Removal of topsoil.
- B. Rough grading the site for site structures, building pads, and parking areas.
- C. Finish grading .

1.02 RELATED REQUIREMENTS

- A. Section 01 4500 - Temporary Erosion Control.
- B. Section 31 1000 - Site Clearing.
- C. Section 31 2316 - Excavation.
- D. Section 31 2323 - Fill and Backfill: Filling and compaction.

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittals for submittal procedures.
- B. B. Samples: Submit 10-lb sample of each type of fill to testing laboratory in air tight containers.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with the plans and these specifications.

1.05 1.05 PROJECT RECORD DOCUMENTS

- A. A. Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts and slope gradients

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Topsoil - Soil Type : Topsoil excavated on-site.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
- B. Other Fill Materials: See Section 31 2323.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Verify site conditions.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Protect bench marks, existing structures, sidewalks, pavements and curbs from excavating equipment and vehicular traffic.
- C. Stake and flag locations of known underground, above ground and aerial utilities.
- D. Protect above and below grade utilities which are to remain.
- E. Notify utility company to remove, rebuild or relocate utilities.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.

- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

- A. Stockpile excavated topsoil on site.
- B. Stockpile topsoil to be re-used on site; remove remainder from site.
- C. Remove excavated topsoil from site.
- D. Stockpile excavated subsoil on site.
- E. Stockpile subsoil to be re-used on site; remove remainder from site.
- F. Remove excavated subsoil from site.
- G. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

3.06 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 1/2 inch from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 1/4 inch from required elevation.

3.07 FIELD QUALITY CONTROL

- A. See Section 31 2323 for compaction density testing.

3.08 CLEANING

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

**SECTION 31 2316
EXCAVATION****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Excavating for footings, slabs-on-grade, and site structures.
- B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 01 57 13 - Temporary Erosion Control.
- B. Section 01 7000 - Execution Requirements: General requirements for dewatering of excavations and water control.
- C. Section 31 22 00 - Grading: Grading.
- D. Section 31 2323 - Fill and Backfill: Fill materials, filling, and compacting.

PART 2 PRODUCTS**2.01 -- NOT APPLICABLE --****PART 3 EXECUTION****3.01 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Locate, identify, and protect utilities that remain and protect from damage.

3.02 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut utility trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excess excavated material from site.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - "Quality Control", for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.04 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

**SECTION 31 2323
FILL AND BACKFILL****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Filling, backfilling, and compacting for site grading and footings, slabs-on-grade, and site structures.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 01 5713 - Temporary Erosion Control.
- B. Section 32 1313 - Portland Cement Concrete Paving: Leveling bed placement under paving.
- C. Section 03 300 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.04 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: That portion on which pavement, concrete, surfacing, base, subbase, or a layer of other material is placed.. For structures, the soil prepared to support the structure.

1.05 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.
- D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.

3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill - Onsite excavated materials are generally considered acceptable.
- B. General Fill: Subsoil excavated on-site.
 1. Rocks larger than 1 inch in the largest dimension should not be placed within the upper 12 inches of fill beneath footings and slabs or the upper 18 inches under paved areas.
- C. Structural Fill: Conforming to State of California Department of Transportation standard.
- D. Structural Fill: Subsoil excavated on-site.
 1. Graded.
 2. Free of lumps larger than 3 inches, rocks larger than 1 inch, and debris.
- E. Concrete for Fill: Lean concrete, 1 or 2 sack slurry.
- F. Granular Fill: Coarse aggregate, conforming to State of California Department of Transportation standard.
- G. Sand: Conforming to State of California Department of Transportation standard.

2.02 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, woven, Structural Geogrid BX1200; manufactured by Tensar Earth Technologies, Inc., or approved equal by Architect; submittal required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Final bottom surfaces of all excavations should be observed and approved by the project geotechnical engineer prior to placement of fill.

3.02 PREPARATION

- A. All structures and pavements should be uniformly supported by compacted fill.
- B. Building footprints and all other structures should over-excavated to at least 5 feet below the bottom of footings.
- C. Over-excavations should extend at least 5 feet beyond the structure footprint.
- D. Depth of over-excavation should be uniform across the entire structure.
- E. Pavement and flatwork areas should be over-excavated at least 1 foot below subgrade
- F. Over-excavation should extend at least 1 foot beyond the edge of paved areas.
- G. Scarify over-excavated bottoms to additional depth of 6 inches
- H. Moisture condition scarified surface:
 1. Coarse-grained materials: Within 3 percent of optimum moisture content.
 2. Fine-grained materials: 0 to 2 percent of optimum moisture content.
- K. Surface should be re-compacted to at least 90 percent of laboratory maximum dry density.

3.03 FILLING

- A. Fill to contours and elevations indicated.
- B. Employ a placement method that does not disturb or damage other work.
- C. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.

- E. 1. Coarse-grained materials: Within 3 percent of optimum moisture content.
- F. 2. Fine-grained materials: 0 to 2 percent of optimum moisture content.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth. Compact to at least 90 percent of laboratory maximum dry density as determined by ASTM Standard D1557.
- H. Slope grade away from building minimum 0.5 feet in 10 feet on pervious surfaces and 0.2 feet in 10 on impervious surfaces, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density at 12 inches below subgrade.
- K. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - "Quality Control", for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.05 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

**SECTION 32 1313
CONCRETE PAVING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Concrete sidewalks, integral curbs, gutters, and parking areas.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 07 9200 - Joint Sealants: Sealing joints.
- C. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2016.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- E. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.
- G. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2017.
- I. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.
- J. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018.
- K. PCA-PA124- Finishing Concrete with Color and Texture.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler and curing compound.

PART 2 PRODUCTS**2.01 PAVING ASSEMBLIES**

- A. Comply with applicable requirements of ACI 301.
- B. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, buff color Portland cement, exposed aggregate finish.

2.02 AGGREGATE BASE

- A. Aggregate Base Course: Thickness and size of aggregate as indicated on the drawings.

2.03 FORM MATERIALS

- A. Wood form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).

2.04 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength; deformed billet steel bars; unfinished.

2.05 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: As specified in Section 03 3000.
- C. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.
- D. Admixtures: Fly ash is not allowed.

2.06 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1, Class A.
- B. Surface Retarder:
 - 1. Color: As selected by Architect from manufacturer's standard range.
 - 2. Used at colored concrete paving.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
 - 1. Material: ASTM D1751, cellulose fiber.

2.07 CONCRETE MIX DESIGN

- A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- B. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.
- C. Concrete Properties:
 - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 4,500 psi.
 - 2. Concrete compressive strength at Driveway Approaches; 4,500psi.

2.08 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Verify base conditions.

3.02 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- D. Place concrete to pattern indicated

3.05 JOINTS

- A. Place 3/8 inch wide expansion joints at 30 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
- B. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab, at 8'-0" O.C.

3.06 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.07 JOINT SEALING

- A. See Section 07 9200 for joint sealer requirements.
- B. Joint Sealant:
 - 1. Surface Preparation: All joints must be absolutely clean. For concrete, sandblasting is required. All curing compounds, old caulks, waterproofing compounds, etc., must be removed. Polyethylene rod or polyurethane foam is recommended as a joint-filler and backup material. Fillers treated with bituminous products, grease or oil, should not be used. Where present, they must be removed or separated by vinyl tape or polyethylene film. All surfaces must be primed with ELASTO-THANE PRIMER.
 - 2. Application: Apply by caulking gun, hand or pressure type, or pour from container. Bulk sealant can be applied by pumping equipment, trowel or putty knife. Press firmly into joint to assure good contact.

3.08 FIELD QUALITY CONTROL

- A. Field Inspection and testing will be performed under provisions of Section 01 4500 - "Quality Control".
- B. Testing firm will take cylinders and perform slump tests in accordance with ACI 301.

3.09 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

**SECTION 32 1713
WHEEL STOPS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Precast concrete parking bumpers and anchorage.

1.02 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- B. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- C. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- D. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Parking Bumpers: Precast concrete, complying with the following:
 - 1. Nominal Size: 5 inches high, 9 inches wide, 6 feet long.
 - 2. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
 - 3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
 - 4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
 - 5. Air Entrainment Admixture: ASTM C260/C260M.
 - 6. Concrete Mix: Minimum 5,000 psi compressive strength after 28 days, air entrained to 5 to 7 percent.
 - 7. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
 - 8. Embed reinforcing steel, and drill or sleeve for two dowels.
 - 9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
 - 10. Minor patching in plant is acceptable, providing appearance of units is not impaired.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install units without damage to shape or finish. Replace or repair damaged units.
- B. Install units in alignment with adjacent work.
- C. Fasten units in place with 2 dowels per unit.

END OF SECTION

**SECTION 32 1723
PAVEMENT MARKINGS**

PART 2 PRODUCTS

END OF SECTION

NOT FOR BID

**SECTION 32 1726
TACTILE WARNING SURFACING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Plastic tactile warning surfacing.

1.02 RELATED REQUIREMENTS

- A. Section 32 1623 - Sidewalks.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2018.
- D. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser; 1984 (Reapproved 2015).
- E. ASTM C903 - Standard Practice for Preparing Refractory Specimens by Cold Gunning; 2015, with Editorial Revision (2016).
- F. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
- G. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- H. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2015.
- I. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2016.
- J. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2011.
- K. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.
- L. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.
- M. SAE AMS-STD-595 - Colors Used in Government Procurement; 2017a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data, standard details, details specific to this project, written installation, and maintenance instructions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to project site in manufacturer's protective wrapping and in manufacturer's unopened packaging.
- B. Store covered and elevated above grade and in manufacturer's unopened packaging until ready for installation. Maintain at ambient temperature between 40 and 90 degrees F.

1.07 FIELD CONDITIONS

- A. Ambient Conditions: Do not install tiles when ambient air temperature is below manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Tactile Warning Surfacing:
 - 1. Armor-Tile, a brand of Engineered Plastics, Inc: www.armortiletransit.com/#sle.
 - 2. EqualTile, a brand of Advanced Roadway Manufacturing, Inc: www.equaltile.com/#sle.
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 MATERIALS

- A. Plastic Tactile Warning Surfacing:
 - 1. Material Properties:
 - a. Water Absorption: 0.20 percent, maximum, when tested in accordance with ASTM D570.
 - b. Slip Resistance: 0.50 minimum dry static coefficient of friction, when tested in accordance with ASTM D2047.
 - c. Compressive Strength: 25,000 pounds per square inch, minimum, when tested in accordance with ASTM D695.
 - d. Tensile Strength: 10,000 pounds per square inch, minimum, when tested in accordance with ASTM D638.
 - e. Flexural Strength: 25,000 pounds per square inch minimum, when tested in accordance with ASTM D790.
 - f. Abrasion Resistance: 300, minimum, when tested in accordance with ASTM C501.
 - g. Accelerated Weathering: Delta-E of less than 5.0 at 2,000 hours exposure, when tested in accordance with ASTM G155.
 - h. Adhesion: No delamination of tile prior to board failure in a temperature range of 20 to 180 degrees F, when tested in accordance with ASTM C903.
 - i. Salt and Spray Performance: No deterioration or other defect after 200 hours of exposure, when tested in accordance with ASTM B117.
 - 2. Installation Method: Cast-in-place.
 - 3. Shape: Rectangular.
 - 4. Dimensions: 24 inches by 48 inches.
 - 5. Pattern: In-line pattern of truncated domes complying with ADA Standards.
 - 6. Edge: Beveled per California Building Code 11b-303.3.
 - 7. Color: SAE AMS-STD-595, Table IV, Federal Yellow No. 33538.

2.03 ACCESSORIES

- A. Fasteners: ASTM A666, Type 304 stainless steel.
 - 1. Type: Countersunk, color-matched composite sleeve anchors.
 - 2. Size: 1/4 inch diameter and 1-1/2 inches long.
- B. Sealant: Elastomeric sealant of color to match adjacent surfaces; approved by surfacing tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. When installation location is near site boundary or property line, verify required location using property survey.
- B. Verify that work area is ready to receive work:
 - 1. If existing conditions are not as required to properly complete the work of this section, notify Architect.
 - 2. Do not proceed with installation until deficiencies in existing conditions have been corrected.

- C. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 PREPARATION

- A. Surface Preparation:

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
 - 1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
 - 2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.
- B. Field Adjustment:
 - 1. Locate relative to curb line in accordance with ATBCB PROWAG, Sections 304 and 305.
 - 2. Orient so dome pattern is aligned with the direction of ramp.
- C. Install units fully seated to substrate, square to straight edges and flat to required slope.
- D. Cast in Place:
 - 1. When installing multiple adjacent units, leave 3/16-inch gap between units to allow for expansion.
 - 2. Tamp and vibrate units as recommended by manufacturer.
 - 3. Place and position weights on units while concrete cures.
 - 4. Ensure no voids or air pockets exist between top surface of concrete and underside of units.
- E. Surface Applied:
 - 1. Cure concrete surfaces for minimum of 4 days before installing units.
 - 2. Mechanically roughen surface as required to remove contaminants and prepare surface for adhesive and sealant application.
 - 3. When installing multiple adjacent units, leave 1/8-inch gap between tiles to allow for expansion.
 - 4. Drill fastener holes straight, true, and to depth recommended by manufacturer.
 - 5. Apply adhesive to back of unit as recommended by manufacturer.
 - 6. Mechanically fasten to substrate. Avoid striking or damaging unit during installation.
 - 7. Apply sealant to edges in cove profile.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Inspect for raised edges and misalignment.
- C. Nonconforming Work: Remove and replace.

3.05 CLEANING

- A. Remove protective plastic sheeting within 24 hours of installation.
- B. Remove excess sealant or adhesive from joints and edges.
- C. Clean four days prior to date of scheduled inspection.

3.06 PROTECTION

- A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.
- B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

**SECTION 32 3119
DECORATIVE METAL FENCES AND GATES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Decorative steel fences.
- B. Automatic gate operators.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- B. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction; 2017.
- C. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings:
 - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
 - a. Provide engineering

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Decorative Metal Fences and Gates:
 - 1. Ameristar Perimeter Security, USA; -: www.ameristarfence.com/#sle.
 - 2. Builders Fence Co Inc. . Basis of Design.
 - a. P O Box 125, Sun Valley, CA 91353-0125. Phone: 800-767-0367.
 - Website www.buildersfence.com
 - 3. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Automatic Gate Operators:
 - 1. Lift Master; www.liftmaster.com; Ph 800-528-5880.
 - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 FENCES

- A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
 - 1. Style BFC HEAVY GUARDIAN
- B. Finish: Galva-Guard III
 - 1. ASTM-A 123

2. Color: As selected by Architect from manufacturer's standard range.
- C. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
 1. Hot-dip galvanized; ASTM A653/A653M, G60.
 2. 62 percent recycled steel, minimum.

2.03 WELDED STEEL FENCE

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.
- B. Fence Panels: Fusion welded; 2 feet high by 6 feet long.
 1. Panel Style: Two rail.
 2. Attach panels to posts with manufacturer's standard panel brackets.
 3. Attach panels to top of CMU wall as indicated on drawings.
- C. Posts: Steel tube.
 1. Size: 2-1/2 inches square by 11 gage, .125 inch, with manufacturer's standard cap.
 2. Post Cap: Flush plate.
 - a. Unless otherwise indicated in drawings.
- D. Rails: Manufacturer's standard, double-wall steel channel 2 inch square by 14 gage, .078 inch with pre-punched picket holes.
 1. Picket Retaining Rods: 0.125 inch galvanized steel.
 2. Picket-to-Rail Intersection Seals: PVC grommets.
- E. Pickets: Steel tube.
 1. Spacing: 3-3/4 inch clear.
 2. Size: 3/4 inch square by 16 gage, .0625 inch.
 3. Style: Pickets with finial extend above top rail.
 4. Finial: Spear point.
 - a. Pickets curve outward to form Anti-Climb fence.
- F. Flexibility: Capable of following variable slope of up to 1:2.
- G. Expanded Metal: Where indicated, #16, 1/2" Diamonds, Flattened.
- H. Pedestrian Gate: Construct as indicated on drawings. Refer to Door Hardware Schedule for lockset.
- I. Vehicle Gate panels shall be as indicated on drawings.
 1. Slide Gate- Motorized at site entry

2.04 MOTORIZED GATE OPERATORS

- A. Provide 1/2-HP gate operators with mouse-proof enclosures, with adjustable automatic timed gate closing device, .
 1. Basis of Design; SL3000, LIFTMASTER, Inc., Oakbrook, IL. (Or approved equal) www.liftmaster.com
 2. Provide vehicle safety loop detector system to include one (1) pair reversing loops, one (1) "shadow" vehicle reversing loop, and one (1) free egress loop. Set in concrete, do not saw-cut concrete.
 3. Provide one (1) International Electronics 232FX Harsh Environment keypad on outside of wall/fence in vandal-resistant metal box with time zone for code control, hood and light with Knox lock on face plate.
 - a. Provide Gooseneck (double) Pedestal: Door King, Dual Mount model 1200-049.
 - b. Provide Keycard type gate control.
 4. Provide six (6) remote control radio entry transmitters and Multi-code 1099-50 receiver with coaxial antenna.
 - a. Remotes are to also Open/Close Overhead Coiling doors.
 5. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.

- a. Primary Device: Provide NEMA 1 photo eye sensors as required with momentary-contact control device.
- b. Secondary Device: Provide electric sensing edge with wireless edge kit as an option along with continuous-constant control device.

2.05 ACCESSORIES

- A. Hardware for Single (personnel) Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates.
 1. Lockset: Refer to Section 08 7100 - "Door Hardware".
 2. Gates shall automatically close with no more than 5 lbs force per ADA requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set fence posts in accordance with the manufacturer recommended spacing.
- C. When cutting rails immediately seal the exposed surfaces by:
 1. Removing metal shavings from cut area.
 2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
 3. Apply two coats of custom finish spray paint matching fence color.
 4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.
- D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
 1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.
- E. Install operator in accordance with manufacturer's instructions and in accordance with NFPA 70.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Gates: Inspect for level, plumb, and alignment.

3.05 CLEANING

- A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- B. Clean fence with mild household detergent and clean water rinse well.

END OF SECTION

**SECTION 32 3313
SITE BICYCLE RACKS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Exterior bicycle racks.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

1.03 REFERENCE STANDARDS

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Exterior Bicycle Racks:
 - 1. American Bicycle Security Company: www.ameribike.com/#sle.
 - 2. Highland Products Group, LLC: www.indoorbikeracks.net/#sle.
 - 3. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com/#sle.
 - 4. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

2.02 BICYCLE RACKS

- A. Exterior Bicycle Racks: Device allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
 - 1. Style: Serpentine rack formed from a continuous round pipe.
 - 2. Capacity: Three bicycles.
 - 3. Mounting, Ground: In-ground anchor.
 - 4. Finish: Powder coat, maintenance-free and weather-resistant.
 - 5. Color: As selected by Architect from manufacturer's standard range.
 - 6. Accessories: In-ground grout cover.
- B. Materials:
 - 1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Examine surfaces to receive bicycle racks.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.
- C. Do not begin installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install level, plumb, square, and correctly located as indicated on drawings.
- C. In-Ground Anchor Installation:
 - 1. Prepare holes in size according to manufacturer's instructions.
 - 2. Place anchoring bolts through the holes in pipe.

3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch from the ground.
4. Place concrete.
5. Level rack before concrete sets.
6. Support until dry.

3.03 CLEANING

- A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 32 8400
LANDSCAPE IRRIGATION****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Automatic sprinkler irrigation systems and controls.

1.02 RELATED REQUIREMENTS

- A. Section 32 9300 - Trees, Plants and Ground Cover.
- B. Division 22 - Plumbing: General Requirements for piping and appurtenant work.
- C. Division 26 - Electrical: General Requirements for electrical work.

1.03 REFERENCE STANDARDS

- A. ANSI B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; '95.
- B. ASTM A536 - Standard Specification for Ductile Iron Castings; '84 (2009).
- C. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2015a.
- D. ASTM B206/B206M - Standard Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) Wire and Copper-Nickel Alloy Wire; '07.
- E. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds; '08.
- F. ASTM D1869 - Standard Specification for Rubber Rings for Asbestos-Cement Pipe; '95 (225)e1.
- G. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride)(PVC) Pressure-Rated Pipe (SDR Series); 2015.
- H. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; '08.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide component and control systems and wiring diagrams.
- C. Record Documents: Record actual locations of all concealed component piping system.
- D. Operation and Maintenance Data:
 - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.
 - 3.

1.05 QUALITY ASSURANCE

- A. Installer's Qualifications: Regularly engaged, and specializing, for the preceding five (5) years, in the installation of equivalent irrigation systems using solvent-gasket joints.
- B. Certifications: Provide electrical wiring, controls, motors, and devices be listed and labeled by Underwriters Laboratories, Inc. (UL).

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of products in system.

1.07 PRE-INSTALLATION MEETING

- A. Convene one (1) week prior to commencing work of this section.

1.08 WARRANTY

- A. Submit warranty forms in accordance with Division 1.
- B. During the warranty period, the Owner reserves the right to make temporary repairs as necessary to maintain the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the warranty as herein specified.
- C. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Design is based on the use of products as indicated on the drawings.
- B. Materials shall be products of one manufacturer and shall be either the ones upon which the design is based or those accepted in advance in accordance with Section 01 60 00 - "Product Requirements".

2.02 GENERAL PIPING

- A. Pressure main line from point of connection (POC) through backflow prevention unit: Type K copper or brass.
- B. Main lines (pressurized) 1-1/2-inch and smaller downstream of backflow prevention unit: Schedule 40 solvent-weld PVC, unless otherwise noted.
- C. Main lines (pressurized) 2-inch through 3-inch downstream of backflow prevention unit: Class 315 solvent-weld PVC, unless otherwise noted.
- D. Main lines (pressurized) 3-inches and larger downstream of backflow prevention unit: Class 200 bell and gasket PVC, unless otherwise noted.
- E. Lateral lines 1-1/2-inch and smaller: Schedule 40 solvent-weld PVC, unless otherwise noted.
- F. Lateral lines 2-inches and larger: Class 315 solvent-weld PVC, unless otherwise noted.

2.03 PLASTIC PIPE FITTINGS

- A. Solvent-weld pipe extruded of an improved PVC virgin pipe compound featuring high impact strength. Conform to ASTM D1784 or D2241 to meet the requirements of cell classification 12454B for pipe. Compound shall have a 2,000 psi hydrostatic design stress rating.
- B. Rubber Gasket PVC Pipe: Conform to ASTM D1784, Type 1, Grade 1, 2,000 psi design stress. Standard dimensional ratio for pipe shall be SDR 21 (Class 200). All pipe shall conform to commercial standards CS-256-64 (pressure rated pipe), and National Sanitation Foundation (NSF) testing laboratories. Rubber gaskets shall conform to ASTM D1869.
- C. All pipe and fittings shall bear the following markings: Manufacturer's name, nominal pipe size, schedule or class, pressure rating psi, NSF, and date of extrusion.
- D. Make solvent cement joints for plastic pipe and fittings as prescribed by the manufacturer.
- E. All PVC fittings shall be Schedule 40 PVC.
- F. All Fittings: Injection molded of an approved PVC fitting compound featuring high tensile strength, high chemical resistance, and high impact strength. Fittings shall conform to ASTM D1784, and meet the requirements of cell classification 12454B. Where threads are required in plastic fittings, these shall be injection molded also. Type: Dura Plastics Products, Spears, or approved by Architect.
- G. Rubber Gasket Fittings: Fittings shall be ductile iron deep bell type. Fittings shall be constructed of grade 65-45-12 ductile iron in accordance with ASTM A536. Fitting gaskets shall be rubber in accordance with ASTM F477. All ductile iron fittings shall be manufactured with exterior lugs and be fitted with a joint restraint system. Type: Harco Ductile Iron Fittings, Leemco Joint Restraint System or as approved by Architect.
- H. All threaded nipples: Standard weight Schedule 80, with molded threads.

- I. All threaded fittings: Use 3/4-inch size teflon tape.
- J. Reclaimed Water Pipe: Pipe shall be extruded of an improved PVC virgin pipe compound featuring high impact strength. Conform to ASTM D1784 or D2241 to meet the requirements of cell classification 12454B for pipe. Compound shall have a 2,000 psi hydrostatic design stress rating. Reclaimed water pipe shall be color coded purple with the words "CAUTION - RECLAIMED WATER" printed in black letters on two sides of the pipe. Reclaimed water pipe shall use standard white Schedule 40 PVC fittings as described above. Type: Alertline, Water Warn or as approved by Architect.
- K. Ultra-Violet Resistant (UVR) Pipe: Pipe shall be Blu-lock Pipe per plans specifications.

2.04 COPPER PIPE AND FITTINGS

- A. Copper Pipe shall be Type K, hard tempered, ASTM B88M, with fittings of wrought solder joint type in accordance with ANSI B16.22. Type Fittings: Nibco or as approved by Architect.
- B. Solder joints with silver solder: 45% silver, 15% copper, 16% zinc, 24% cadmium and solidus at 1125 degrees F, and liquidus at 1145 degrees F, conforming to ASTM B206 and FS QQB-655C.

2.05 BRASS PIPE AND FITTINGS

- A. Brass pipe shall be 85% red brass, American National Standard Institute (ANSI), Schedule 40 screwed pipe.
- B. Fittings shall be medium brass, screwed, 125-pound class.

2.06 VALVES

- A. Ball Valves: 2-inches and smaller (unless otherwise noted on Drawings): 150 psi operating pressure, maximum port design, Schedule 80 construction, with "O" ring seals. Nibco, Hammond, or as approved by Architect.
- B. Butterfly Valves: 3-inches and larger - 150 psi operating pressure, maximum port design, brass construction, with threaded connections. Nibco, Hammond, or as approved by Architect.
- C. Remote Control Valves: Size and type as shown on Drawings. Same manufacturer as controller.
 - 1. Valve Type: Spring-loaded, self-cleaning, packless diaphragm activated, normally closed type with Dupont-Zytel body, equipped with manual flow control.
 - 2. Valve Solenoid: 24 volt AC, 4.5 watt maximum, 500 milliamp maximum surge, corrosion-proof, stainless steel construction, epoxy encapsulated to form a single integral unit.
 - 3. Provide manual bleeder valve to permit operation in the field without power at the controller.

2.07 HEADS

- A. Small Lawn Sprinkler Heads: In accordance with size, type and coverage noted on Drawings.
 - 1. Body: Plastic as noted on Drawings.

2.08 BACKFLOW PREVENTION UNITS

- A. Backflow Preventer: In accordance with Irrigation Legend on Drawings.

2.09 AUTOMATIC CONTROLLER

- A. Provide type and size as noted on Drawings.
 - 1. Provide UL approved on-off switch and electrical outlet for 120 volt electrical service. Locate inside building.

2.10 ELECTRICAL WIRING AND SERVICE

- A. High Voltage: Electrical service to automatic controller shall be in accordance with Division 26 Sections. Provide final hookup to equipment as a part of the work of this section.
- B. Low Voltage:

1. Connections between controller and remote control valves shall be made with direct burial AWG-UF 600 volt wire, 14 gauge or larger, insulation thickness 3/64-inch, utilizing low density, high molecular weight polyethylene insulation.
2. Splices, where permitted, shall be waterproofed using Rainbird, Snap-Tite, Scotch-Lok No. 3576 Connectors, or fusible heat shrink tubing.
3. Pilot wires shall be red or black. Minimum size shall be No. 14 gauge.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of existing utilities.
- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Verification of Conditions: Prior to work of this section, examine previously installed work and verify that such work is complete, and as required, to the point where this installation may properly commence.

3.02 PREPARATION

- A. Protection: Protect previously installed work and materials which may be affected by work of this section.
- B. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover and structures.
- C. Layout and stake locations of system components.
- D. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 INSTALLATION

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
- B. Plastic Pipe and Threaded Fittings: Install in accordance with manufacturer's instructions.
 1. Assemble using approved primer and solvent to all plastic-to-plastic joints.
 2. Pipe shall be snaked within the trench as much as possible to allow for expansion and contraction.
 3. Assemble plastic pipe and threaded fittings using Teflon tape, applied to threads only.
- C. Swing Joints: Provide swing joint assemblies fabricated in accordance with Drawings.
- D. Backflow Assemblies: Install in shrub areas at minimum height permitted by local code.
- E. Backflow Prevention Unit and Automatic Controllers: Verify location with Architect. Install in accordance with manufacturer's instructions.
- F. Sprinkler Heads:
 1. Heads shall be installed as noted on Drawings.
 2. Elevate full heads in lawn areas to a minimum of 3-inches above grade.
 3. Install heads along curbs, walks, and paving, level with grade in lawn areas.
 4. Lower raised heads within ten days after notification by the Owner.
 5. Set all heads perpendicular to finished grade, unless otherwise directed by the Architect.
- G. Remote Control Valves: Install where shown on Drawings. When grouped together, allow at least 12-inches between valves. Install each control valve in a separate valve box.
- H. Install drip emitters per detail on plans.

3.04 UTILITY SERVICES

- A. Connect to existing water service at locations indicated on Drawings and make minor changes in location necessary due to actual site conditions as work of this section. Adapt to existing pipe using new couplers and reducers.
- B. Connect to existing electrical service. Make minor changes in location as necessary due to actual site conditions as work of this section.

3.05 WIRING

- A. Place wiring in the same trench and along the same routing as the pressure supply lines, except as otherwise approved.
 - 1. Install wiring prior to main line whenever possible.
 - 2. When more than one wire is placed in trench, tape wires together at maximum 10-foot centers, and lay to one side of trench.
- B. Provide an 18-inch expansion loop at each connection and directional change. Provide a sufficient length at each splice to allow valve bonnet to be brought to the surface without disconnection.
- C. Use a continuous wire between controller and remote control valves.
 - 1. Except as otherwise approved, do not splice wire at any point.
 - 2. Approved splices shall be made with Rainbird ST-03UL, Snap-Tite wire connectors with PT/55 sealer. Enclose in a box.
 - 3. Run two spare No. 14 gauge wires from controller along entirety of main line to last electrical control valve on each and every leg of main line. Label spare wires at both ends.

3.06 FIELD QUALITY CONTROL

- A. Contractor's Responsibility:
 - 1. Provide seven (7) days notice for Final Review.
 - 2. Provide up-to-date Project Record Drawings at this review.
- B. Pressure Tests:
 - 1. Do not install remote control valves, or any other valve assembly until testing of pressure main lines is completed and approved.
 - 2. Provide equipment necessary to test systems, including force pump.
 - 3. Perform hydrostatic tests in presence of the Architect.
- C. System Flushing: After sprinkler pipe lines and risers are in place and connected, and prior to installation of sprinkler heads, thoroughly flush all lines with a full head of water. Install sprinkler heads after lines have been flushed to the satisfaction of the Architect.
- D. Coverage Tests:
 - 1. Perform coverage tests after sprinkler system is completed, but prior to any planting, in the presence of the Architect.
 - 2. Test system to ensure that planting areas are watered adequately and uniformly.
 - 3. Make necessary adjustments, including realignment of heads, to provide required coverage as directed by the Architect.
 - 4. If it is determined that coverage can be improved by a nozzle change, make such changes, or arrange with the manufacturer to have such changes made, as part of the work of this section. Make changes prior to any planting.

3.07 CLEANING

- A. Upon completion of the work, restore ground surfaces to required elevations and remove excess materials, debris and equipment from the site.

3.08 DEMONSTRATION

- A. Provide instruction to maintenance personnel in proper operation of equipment in accordance with Division 1.

END OF SECTION 32 84 00

**SECTION 32 9300
TREES, PLANTS AND GROUND COVER**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Soil preparation and fertilization.
- B. Planting operations.
- C. Landscape planting materials.
- D. Provide landscape planting in the areas shown on Drawings, with plants in a healthy, vigorous growing condition. Items not specifically shown on Drawings or specified, but normally required to conform with such intent, are considered part of the work.
- E. Include labor and equipment required to place, and amend the soil. Include the cost of fertilizer as specified. If the final soils analysis results in a change to the specified amendments, a Change Order will be issued.

1.02 RELATED REQUIREMENTS

- A. Section 32 8400 - Landscape Irrigation.

1.03 REFERENCE STANDARDS

- A. American Joint Committee on Horticulture Nomenclature (AJCHN):
 - 1. Standardized Plant Names, latest edition.
- B. American Association of Nurserymen, Inc. (AAN):
 - 1. American Standard for Nursery Stock, latest edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.
- C. Quality Control Submittals:
 - 1. Substitutions:
 - a. If any plant specified is not obtainable, submit a written substitution request to the Architect during the bidding period.
 - b. Substitutions of plant materials will not be permitted unless accepted in advance in accordance with Division 1 provisions.
- D. Selection, Tagging and Ordering Plant Material:
 - 1. Submit a request for inspection and documentation to the Architect, at least one month prior to start of landscape work, and confirm that plant material has been ordered.
 - 2. Plants shall be subject to an examination and acceptance-review by the Architect after delivery for conformity to this Specification.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable laws, codes and regulations required by authorities in furnishing, transporting and installing materials.
- B. Certificates: Submit certificates for the following items upon delivery to the job site:
 - 1. Quantity of fertilizer and minerals.
 - 2. Quantity of soil amendments.
 - 3. Quantity of other soil additives per agronomic soils test report.
- C. Pre-Installation Conference: Provide written projected planting schedule noting the estimated completion date, number of working days required, and special coordination requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle plants in a manner to avoid any damage to the plant. Protect plants from sun or drying winds. Protect and maintain plants that cannot be planted immediately upon delivery.

1.07 WARRANTY

- A. Plant Material:
 - 1. Plant materials furnished under this section shall be warranted in writing, for a period of six (6) months for all trees, six (6) months for all other material, from the date of Notice of Completion for all material, against improper installation, and against defective, unsound or diseased conditions that may appear.
 - 2. Upon receipt of written notice from the Owner of the death of any warranted plant materials during the warranty period, the subject plant materials shall be promptly replaced with the same species originally planted, and of a size closely approximating the size of the plant if normal growth had occurred since the original planting. Replacements shall be subject to the requirements of this Specification.
 - 3. When plants are replaced, advise the Owner in writing, of the necessary establishment maintenance which must be performed.
 - 4. Contractor shall not be held liable for loss of plant materials that have not been maintained properly by the Owner.
 - 5.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Materials shall be the products of one manufacturer and shall be the products of manufacturer accepted in advance in accordance with Division 1.

2.02 MATERIALS

- A. Fertilizer/Soil Conditioner:
 - 1. Provide commercial fertilizer, uniform in composition, free-flowing, suitable for application with approved equipment, and delivered to site in unopened containers, each fully labeled according to applicable fertilizer laws, and bearing the name or mark of the manufacturer. Best, or equal.
 - 2. Provide 16-6-8; 12-12-12; 12-8-8 and 17-13-5, as indicated on Drawings.
- B. Accessory Materials:
 - 1. Ferrous Iron Sulfate: First quality commercial grade.
 - 2. Agricultural Gypsum: First quality commercial grade.
 - 3. Calcium Carbonate Lime: First quality commercial grade.
- C. Other materials, not specifically described but required for a complete and proper installation of the work of this section, shall be new, first quality of their respective kinds, and subject to review and acceptance by the Architect.

2.03 PLANT MATERIALS

- A. Identification: Plant material shall be true to type and nomenclature in accordance with AJCHN Standardized Plant Names, and each bundle or plant shall be properly identified with durable, legible labels.
- B. Quality and Size of Plants: In accordance with rules and grading of AAN American Standard for Nursery Stock, and as shown on the Drawings.
 - 1. Trees, shrubs, vines and ground cover shall have a normal habit of growth and shall be sound, healthy, vigorous and free from insect infestations.
 - 2. Plants that meet the measurements specified, but do not possess a normal configuration or balance of height and spread, will be rejected.
 - 3. Trees and shrubs shall have grown in containers of the size stated on Drawings and shall have sufficient roots to hold the root ball together after removal from containers without being root bound.

4. Trees will be straight and of uniform shape without damaged, crooked or multiple leaders. Trees with abrasions of the bark, sun scalds, disfiguring knots, or fresh cuts of limbs over 1/2-inch that have not been pruned and painted or completely callused, will be rejected.

2.04 SOURCE QUALITY CONTROL

- A. Testing Laboratory shall be an approved Soil and Plant Laboratory. Tests shall be paid for by the Contractor.
- B. Furnish a soils analysis of existing soil. Submit one (1) quart of soil per location. (Three locations minimum).
 1. Submit soil testing laboratory's findings to Architect within five (5) days prior to backfilling.
- C. Soil testing shall be conducted for organic suitability after completion of planting in the soil preparation and backfill mix areas. Submit to the Testing Laboratory the original Amendment Specification with previously issued bulletins for soil amendments and installation procedures. Provide three (3) random samples of planting soil for analysis. Fertility analysis, recommendations, and interpretations shall be furnished by the Testing Laboratory to ensure all specified amendments made have been provided.
- D. Samples of materials, including fertilizers, soil conditioners, plants and other specified materials, shall be submitted for inspection. Delivery may begin upon approval of samples.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Inspect and accept the condition of the site relative to this section before commencing work. If not acceptable, notify the Architect in writing. By proceeding with the work of this section, the Contractor indicates his acceptance of previous related work.
 1. Landscape work shall not begin until construction activities and irrigation systems have been accepted by the Architect.

3.02 PREPARATION

- A. Soil amendments shall be rototilled into the top 12" for lawn areas and installed in all plant pits per the planting details show on plans.
- B. Protection of In-Place Conditions:
 1. Provide safeguards and exercise caution against injury or defacement of existing site improvements
 2. Be responsible for any damage resulting from landscape planting operations. Repair damage and return the area to the previous conditions at no additional cost to the Owner.

3.03 FERTILIZING AFTER PLANTING

- A. Planting areas shall receive an application of 16-6-8 commercial fertilizer at the rate of 7-1/2 pounds per 1,000 square feet, 30 days after planting.
- B. Apply all fertilizer with injector per plans.
- C. Fertilizer application shall be repeated at 30-day intervals until the end of the maintenance period.

3.04 FIELD QUALITY CONTROL

- A. General: Notify Architect at least 24 hours in advance when requesting on-site reviews.
- B. Pre-Maintenance Review:
 1. At the completion of landscape planting operations and prior to the beginning of the formal maintenance period, the Pre-Maintenance Review shall be held.
 2. Request on-site review by the Architect, five (5) working days prior to the completion of work, in order that a mutually agreeable time for review may be arranged.
 3. If, after the Pre-Maintenance Review the Architect is of the opinion that the work has been performed in accordance with the Drawings and Specifications, written notice of preliminary acceptance will be given. This report will note any items which must be

corrected, and state the date of commencement and completion of the formal maintenance period.

3.05 CLEANING

- A. Keep all areas of the work clean, neat and orderly at all times during the period of Contract. Clean construction areas at the end of each day.

END OF SECTION 32 93 00

NOT FOR BID

**SECTION 33 5613
ABOVE-GROUND FUEL STORAGE TANKS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Pre-cast concrete vault enclosing a steel tank and a 30-mil polyethylene sealed bag.
- B. Diesel dispensing package.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Division 26 - Electrical:

1.03 REFERENCE STANDARDS

- A. NFPA 30- Flammable and Combustible Liquids Code; National Fire Protection Association; 2018.
- B. UL 142 - Steel Above-Ground Tanks for Flammable and Combustible Liquids; Underwriters Laboratories; '07.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of _____ with size, location and installation of service utilities.

1.05 SUBMITTALS

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Product Data: Provide data on equipment and accessories.
- C. Shop Drawings: Indicate tank layout and configuration, equipment locations and dimensions.
- D. Manufacturer's Installation Instructions: Indicate special installation procedures.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Include operation, maintenance and inspection data, replacement part numbers, availability and service depot location and telephone number.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and ordinances for above-ground fuel storage tanks.
- B. All proposed sites shall be reviewed and approved by the appropriate Fire Department officials.
 - 1. It shall be the Contractor's responsibility to apply for and obtain all necessary approvals and permits. This includes County and Fire Department.
- C. Above-ground tanks shall conform to UL 142.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 60 00 - "Product Requirements".

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide twenty-year warranty against manufacturing defects.

PART 2 PRODUCTS**2.01 SYSTEM**

- A. The systems shall be complete and comply with requirements of governing local and state agencies. Nothing indicated on the Drawings or Specifications that is not in conformity with the above, shall be construed as deviating from the above. Specifications and Drawings are as guidelines within minimum requirements indicated.
- B. The system shall include one (1) 5,000 gallon above-ground fuel oil (diesel) tank, with appropriate appurtenant, herein specified, equipment, piping and wiring.

2.02 MANUFACTURERS

- A. Convault.
- B. Supervault.
- C. Or approved equal.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS AND COMPONENTS - ABOVE-GROUND FUEL VAULT

- A. Steel tank shall be UL listed.
- B. Steel tank shall meet requirements of NFPA 30 for above-ground tanks.
- C. Steel tank shall have 6-inch emergency vent as required by NFPA 30.
- D. Steel tank shall be rectangular
- E. Steel tank openings shall be threaded, except for detector tube.
- F. Steel tank and secondary containment shall be encased in six (6) inches of reinforced concrete.
- G. Vault shall have capability of physical monitoring between primary and secondary containment.
- H. Vault shall have exterior protective epoxy coating.
- I. Vault shall have code required warning signs.

2.04 EQUIPMENT

- A. Diesel Equipment Package - Side Mounted - Standard Flow.
 - 1. Warranty: 1 Year on Parts, 90 Days on Labor.
 - 2. Dresser Wayne S1 Reliance Dispenser & Pulsers.
 - 3. Fill Rite 713, 1/2 HP electric pump 115V.
 - 4. UL connecting hoses from pump to dispenser.
 - 5. Side Mount Bracket for above Dispenser.
 - 6. 3/4" Fuel Filter and Adapter.
 - 7. High Hose Retractor & Clamp with 3/4" x 20' Fuel Hose.
 - 8. 3/4" Breakaway & Whip Hose.
 - 9. 3/4" Swivel & Automatic Nozzle.
- B. Or approved equal.
- C. Substitutions: See Section 01 6000 - "Product Requirements".

2.05 ACCESSORIES

- A. Fuel Terminal: Install Owner Provided unit. Refer to Electrical Plans.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are ready for vault installation.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Contractor must be a certified installer approved by the manufacturer.
- B. Install operating equipment, piping and fittings in accordance with component manufacturer's instructions.

- C. Clean and flush tank. Seal until pipe connections are made.
- D. Install in accordance with manufacturer's instructions.

END OF SECTION

NOT FOR BID

Appendix "A"
Geotechnical Investigation

August 20, 2024
Project No. S168-193

STK ARCHITECTURE, INC.
42095 Zeno Drive, Suite A15
Temecula, California 92590

Attention: Tony Finaldi

Subject: Geotechnical Investigation
Proposed Fire Station 227
NWC Genevieve Street N. and W. 38th Street
San Bernardino, California

Dear Mr. Finaldi:

This report presents the results of the geotechnical investigation for the proposed Fire Station 227. The investigation was conducted in general conformance with our proposal dated March 6, 2024.

This report includes project design and construction recommendations along with the field and laboratory data. The primary geotechnical issues are the potential for strong ground shaking and the presence of variable soil conditions within the building areas that will require removal and recompaction.

We appreciate the opportunity to work with you on this project. Please call if you have any questions or need any other information.

Sincerely,
INLAND FOUNDATION ENGINEERING, INC.

Allen D. Evans, P.E., G.E.
Principal


Christopher Hogan Rangel, PG
Project Geologist
ADE:CHR:sd



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NOT FOR BID

INTRODUCTION

This report presents the results of the geotechnical investigation conducted for the proposed San Bernardino County Fire Station 227. Fire Station 227 will be located on the northwest corner of Genevieve Street N. and W. 38th Street in San Bernardino, California. Our project understanding was based on the discussions with STK Architecture and review of the following plan.

- FS 227 – Conceptual Site Plan, W. 38th Street, San Bernardino, CA, prepared by STK Architecture Inc, dated June 12, 2024

SCOPE OF SERVICE

The purpose of this geotechnical investigation was to provide geotechnical parameters for design and construction of the proposed project. The scope of the geotechnical services included:

- *Evaluation of existing geologic conditions at the site and review of potential geologic and seismic hazards.*
- *Evaluation of the local and regional tectonic setting and historical seismic activity, including a site-specific ground motion analysis.*
- *Reconnaissance of the site and surrounding area to ascertain the presence of unstable or adverse geologic conditions.*
- *Subsurface sampling and laboratory testing.*
- *Analysis of the data collected and the preparation of this report with geotechnical engineering conclusions and recommendations for design and construction.*

Evaluation of hazardous waste was not within the scope of services provided.

PROJECT DESCRIPTION

The Fire Station No. 227 project will consist of the construction of a new single-story structure comprising approximately 9,870 square feet. The station will be constructed on the southerly portion of the existing Arrowhead Elementary School property.

The fire station will include 3 truck bays, sleeping quarters for 8 crew members and will provide storage for 2 Type 1 Engines and a future ladder truck. A storage building and generator / fuel tank pad will be constructed in the northwest site area. Foundations for

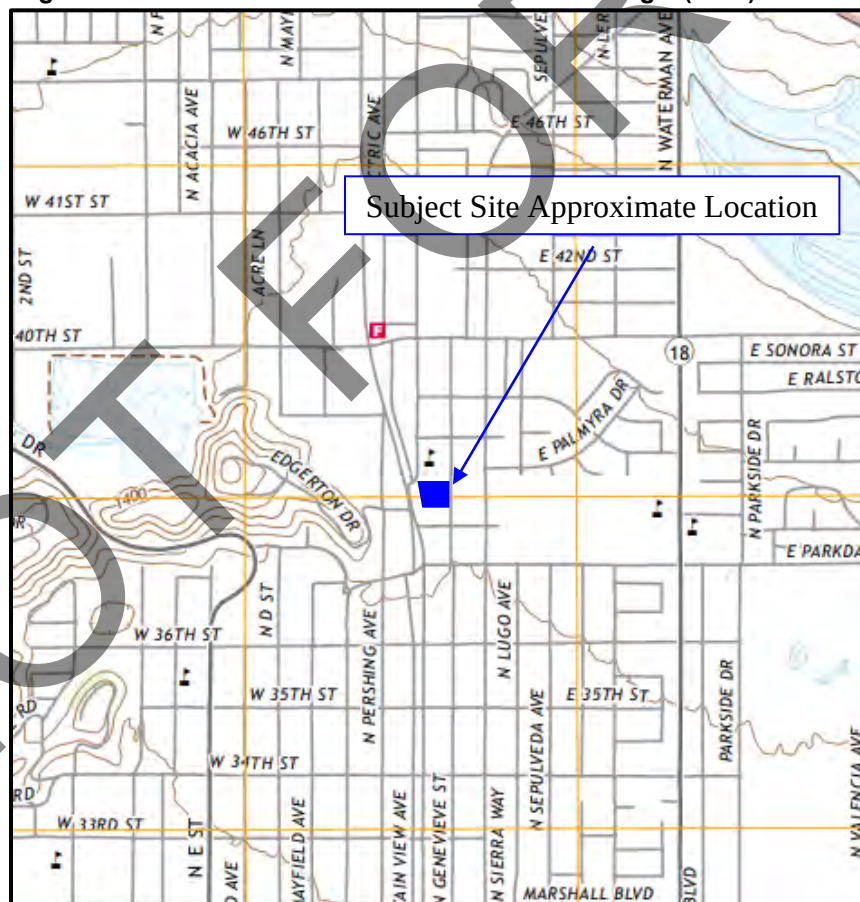
the proposed structures are expected to consist of shallow continuous and isolated concrete spread footings with slab-on-grade floors. Off-site improvements on Genevieve Street and 38th Street will be necessary. Site grading is expected to consist of minor cuts and fills of 2 to 3 feet, exclusive of remedial removals as recommended in this report.

Stormwater infiltration basins are planned in the southern and northwestern portions of the site. The basin depths are expected to be no deeper than five feet below existing surface grades.

SITE DESCRIPTION

The subject site is located on the northwest corner of Genevieve Street N. and W. 38th Street in San Bernardino, California (34.160118°, -117.286677°). The site occupies 1.21 acres and is currently covered with a grass field and large trees on the east, west and south sides. Figure 1 below shows the site location.

Figure 1: USGS San Bernardino North 7.5' Quadrangle (2021)



According to Google Earth, elevations at the site range from 1,279 to 1,283 feet above mean sea level (msl). The site slopes generally to the south at an overall rate of approximately 2 percent.

GEOLOGIC HAZARDS EVALUATION

A geologic hazards report for this project was prepared by our subconsultant, Terra Geosciences, and is appended. The engineering geology and seismicity review was performed using the suggested “Checklist for the Review of Geologic/Seismic Reports for California Public Schools, Hospitals and Essential Services Buildings” (California Geologic Survey, Note 48, 2022).

The geologic hazards study indicates that the proposed fire station and associated structures are considered feasible from a geologic standpoint, providing that the conclusions and recommendations presented in the report are considered during planning and construction. No adverse geologic conditions were found within the proposed construction area, with the exception of the potential for strong ground shaking from nearby seismogenic fault sources.

The geologic hazards study included a site-specific ground motion analysis. The mapped spectral acceleration parameters, coefficients, and other related seismic parameters were evaluated using the OSHPD Seismic Design Maps web application (OSHPD, 2020) and the California Building Code criteria (CBC, 2022), with the site-specific ground motion analysis being performed following Section 21 of the ASCE 7-16 Standard (2017). The results of the site-specific analysis are summarized and tabulated in Table 1 below:

Table 1: Seismic Design Parameters

Factor or Coefficient	Value
S_s	2.506g
S_1	1.002g
F_a	1.2g
F_v	1.7g
S_{DS}	1.670g
S_{D1}	1.620g
S_{MS}	2.506g
S_{M1}	2.429g
T_L	8 Seconds
MCE_G PGA	0.95g
Site Class	D

SUBSURFACE CONDITIONS

Subsurface exploration at the site consisted of four (4) exploratory borings to depths ranging from approximately 16.5 to 50.5 feet below existing site grades. The site exploration is described in Appendix A. Boring locations are shown on Figure A-2.

The soil encountered in the borings consisted of quaternary alluvial materials comprised of interlayered silty sand (SM), sand with silt and gravel (SP/SW-SM), and silty clayey sand (SC-SM). Cobbles and boulders were encountered in boring B-01 at a depth of 30.5 feet. The soil encountered was generally fine to very coarse grained, loose to very dense and in a slightly moist to moist state.

Corrosion Potential: Analytical testing indicates the concentration of sulfates is 52 ppm. In accordance with ACI 318, Table 4.2.1, the soil is classified as having a negligible sulfate exposure. The chloride concentration in the tested sample was 30 ppm and indicates that the soil is generally not corrosive with respect to ferrous metal. The soil is alkaline with a pH value of 8.5. The saturated minimum resistivity value of 7,790 ohm-cm indicates the soil may be moderately corrosive to buried ferrous metal. Alternative material such as PVC piping should be considered in the project design. Inland Foundation Engineering, Inc. does not practice corrosion engineering. A qualified corrosion engineer should be consulted for additional guidance.

Hydrocollapse Potential: Consolidation testing indicates that the soil is compressible and normally consolidated. The results show a slight to moderate potential for hydrocollapse when saturated under anticipated foundation and soil overburden loads. Provided that the building pad area is prepared as recommended herein, and appropriate surface drainage is provided in accordance with contemporary design practice, the potential for adverse building settlement due to hydrocollapse is not significant.

Expansive Soil: The site soil is granular, non-plastic, and non-expansive. Design measures to mitigate soil expansion are not necessary.

Groundwater: Groundwater was not encountered within the exploratory borings, which extended to a maximum depth of 50.5 feet below existing ground surface. Based on a review of pertinent groundwater data (referenced in appended geologic hazards report), the depth to the high groundwater mark in the general region is greater than 120 feet.

Liquefaction and Seismically-Induced Settlement: In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soil that can result in the settlement of buildings, ground failure, or other hazards. The main factors contributing to this phenomenon are: 1) cohesionless, granular soil with relatively low density (usually of Holocene age); 2) shallow ground water (generally less than 50 feet);

and 3) moderate to high seismic ground shaking. Based on current and historical groundwater levels of more than 120 feet below ground surface, the potential for soil liquefaction is not significant.

“Dry sand” settlement occurs in loose granular soil as a result of seismic ground shaking. The potential for “dry sand” settlement was evaluated using GeoSuite® software and Pradel’s method (1998). The results indicate a potential for seismically-induced “dry sand” settlement of less than 1 inch. The estimated differential seismic settlement is less than ½ inch over 30 feet. A discussion of the seismic settlement analysis, with graphic results, is included in Appendix D.

INFILTRATION TESTING

Infiltration testing was conducted in general accordance with Appendix D of the Technical Guidance Document for Water Quality Management Plans, prepared by CDM Smith for the County of San Bernardino Areawide Stormwater Program (2013). The shallow percolation test method was used per the Riverside County Department of Environmental Health guidelines. Four percolation tests were performed at the locations shown on Figure A-7. The testing procedures are described, and the test data is included in Appendix C of this report.

The test results are shown in Table 2. The corresponding calculated infiltration rate (I_c) ranges from 2.0 inches per hour to 5.7 inches per hour. These values exclude a factor of safety. The appropriate factor of safety should be determined by the design engineer.

Table 2: Infiltration Rate

Percolation Test No.	Percolation Rate (min/in)	Depth Below Ground Surface (in)	Infiltration Rate (I_c) (in/hr)
P-01	1.0	60	5.7
P-02	1.0	48	5.7
P-03	2.5	60	2.0
P-04	1.0	48	5.7

CONCLUSIONS AND RECOMMENDATIONS

The primary geotechnical issue that will require mitigation is the presence of loose compressible near surface soil conditions within the proposed structure areas. The near surface soil is not suitable for supporting foundations in its existing condition and should be over-excavated and recompacted. This and other geotechnical engineering recommendations for project design and construction are presented below.

Foundation Design: The proposed fire station and associated structures can be supported by shallow continuous and isolated spread footings designed with an allowable bearing pressure of 2,000 pounds per square foot (psf). Footings should have a minimum width of 12 inches and bottoms a minimum depth of 12 inches below the lowest adjacent grade. The allowable bearing pressure can be increased by 400 psf for each additional foot of width and by 800 psf for each additional foot of depth, to a maximum allowable bearing pressure of 4,000 psf. The allowable bearing pressure can be further increased by $\frac{1}{3}$ for short-term transient wind and seismic loads.

Static settlement of footings designed and constructed as recommended herein is expected to be less than one inch. Differential settlement between footings of similar size and load is expected to be less than one-half inch.

Lateral Resistance: Resistance to lateral loads will be provided by a combination of friction acting at the base of the slab or foundation and passive earth pressure. A coefficient of friction of 0.45 between soil and concrete may be used with dead load forces only. A passive earth pressure of 250 psf/ft may be used for the sides of footings poured against recompactd or dense native material. These values may be increased by $\frac{1}{3}$ for short-term transient wind and seismic loads. Passive earth pressure should be ignored within the upper one foot, except where confined as beneath a floor slab, for example.

Lateral Earth Pressure: Retaining walls should be designed for an active earth pressure equivalent to that exerted by a fluid weighing not less than 40 pcf. Any applicable construction or seismic surcharges should be added to this pressure. Retaining wall backfill should have an expansion index of less than 20.

Concrete Slabs-on-Grade: Concrete slabs-on-grade should have a minimum thickness of four inches. During final grading and prior to the placement of concrete, all surfaces to receive concrete slabs-on-grade should be compacted to maintain a minimum compacted fill thickness of 12 inches.

Load bearing slabs should be designed using a modulus of subgrade reaction (k) not exceeding 200 pounds per square inch per inch. This value is based on an applied foundation load area of 1.0 square foot. The k value should be reduced for larger foundation areas according to the following formula:

$$k_R = k * ((B+1) / 2B))^2$$

where k_R = reduced modulus of subgrade reaction
B = foundation width (feet)

Slabs should be designed and constructed in accordance with the provisions of the American Concrete Institute (ACI). Shrinkage of concrete should be anticipated and will result in cracks in all concrete slabs-on-grade. Shrinkage cracks may be directed to saw-cut "control joints" spaced on the basis of slab thickness and reinforcement.

Control joint spacing in unreinforced concrete at maximum intervals equal to the slab thickness times 24 is recommended.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder/barrier designed and constructed according to the American Concrete Institute 302.1 R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder/barrier construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage.

Portland Cement Concrete (PCC) Pavement: All surfaces that will support fire apparatus should be paved with Portland cement concrete (PCC). PCC pavement should consist of 9 inches of PCC over 6 inches of Class 2 aggregate base. The concrete should have a minimum 28-day modulus of rupture of 600 psi. This corresponds to a compressive strength of approximately 4,500 psi. The Class 2 aggregate base should comply with current Caltrans requirements. The aggregate base should be compacted to at least 95 percent relative compaction based on ASTM D1557. The upper 12 inches of pavement subgrade soil, below the aggregate base, should also be compacted to a minimum relative compaction of 95 percent.

The concrete pavement should be constructed with doweled joints and be restrained laterally by concrete curb/gutter or building foundations. The edges of the concrete should be protected from traffic loads by curbs or paved shoulders. If unrestrained pavement edges or non-doweled joints are desired, this firm should be contacted so that revised recommendations can be developed.

Construction joints should be sawcut in the pavement at a maximum spacing of 30 times the thickness of the slab, up to a maximum of 15 feet. Pavement sawcutting should be performed within 12 hours of concrete placement, preferably sooner. Sawcut depths should be equal to approximately $\frac{1}{4}$ of the slab thickness for conventional saws or one inch when early-entry saws are utilized on slabs nine inches thick or less. Construction joints should not be placed near flow lines. The use of plastic strips for formation of jointing is not recommended. The use of expansion joints is not recommended, except where the pavement will adjoin structures.

Asphalt Concrete Pavement: Recommended asphalt concrete structural pavement sections are shown below in Table 3.

Table 3: Asphalt Concrete Pavement

Service	Asphalt Concrete Thickness (ft.)	Base Course Thickness (ft.)
Light traffic (autos, parking areas, T.I. = 5.0)	0.25	0.35
Heavy traffic (trucks, driveways, T.I. =7.0)	0.30	0.45

Inland Foundation Engineering, Inc. does not practice traffic engineering. The T.I. values used to develop the recommended pavement sections are typical for projects of this type. The project civil engineer or traffic engineer should review the T.I. values used to verify that they are appropriate for this project.

General Site Grading: All grading should be performed per the applicable provisions of the 2022 California Building Code and the following recommendations.

- 1. Clearing and Grubbing:** All building and pavement areas and all surfaces to receive compacted fill should be cleared of vegetation, debris, and other unsuitable materials. All such material should be disposed of off-site.

All undocumented artificial fill and loose native soil within the grading limits should be completely removed. Such material is suitable for use as compacted fill as recommended herein.

- 2. Preparation of Surfaces to Receive Compacted Fill:** All surfaces to receive compacted fill should be reviewed by a geologist or engineer from this firm prior to processing. If roots or other deleterious materials are encountered or if the exposed excavation bottom is loose or unstable, additional over-excavation may be required until satisfactory conditions are encountered. Upon approval, surfaces to receive fill should be scarified to a minimum depth of eight inches, brought to near optimum moisture content, and compacted to a minimum of 90 percent relative compaction.

- 3. Placement of Compacted Fill:** Fill materials consisting of on-site soil or approved imported granular soil should be spread in shallow lifts and compacted at near optimum moisture content to a minimum of 90 percent relative compaction, based on ASTM D1557. Fill placed within 10 feet of finish grade should not contain any particles larger than 12 inches (boulders). Boulder-size particles should be disposed of off-site or in designated rock disposal fill areas.

- 4. Import Soil:** All proposed import soil should be tested prior to placement on the site to verify that it is not corrosive or expansive. Recommended import soil criteria are shown in the following Table 4.

Table 4: Recommended Import Soil Criteria

Sieve Size	Recommended Criteria
Percent Passing 3-Inch Sieve	100
Percent Passing No. 4 Sieve	85 – 100
Percent Passing No. 200 Sieve	15 – 40
Plasticity Index	Less than 15
Expansion Index (ASTM D4829)	20 or less (very low)
Organic content	Less than 1 percent by weight
Sulfates	< 1,000 ppm
Min. Resistivity	> 10,000 ohm-cm

- 5. Preparation of Building Areas:** All proposed building areas should be over-excavated to a depth of at least 8 feet below existing grade or 24 inches below the bottom of the deepest footing, whichever is greater. Building area excavation should extend laterally for at least 5 feet outside of exterior building foundation lines. Following excavation, the exposed soil should be evaluated by this firm to verify it is suitable to receive compacted fill. The removed soil should be placed and compacted as recommended above. Soil within 5 feet of finish grade and within 2 feet of footing and slab bottoms should not contain any particles larger than 3 inches (cobbles).
- 6. Preparation of Paving Areas:** During final grading and immediately prior to the placement of aggregate base, all surfaces to receive asphalt concrete or Portland cement concrete paving should be processed to remove all particles larger than 3 inches within 12 inches of subgrade. The upper 12 inches of pavement subgrade should be tested to assure compaction for a depth of at least 12 inches. Compaction within proposed pavement areas should be to a minimum of 95 percent relative compaction for both the subgrade and base course.
- 7. Utility Trench Backfill:** Utility trench backfill consisting of the on-site soil types should be placed by mechanical compaction to a minimum of 90 percent relative compaction. This is with the exception of the upper 12 inches under pavement areas where the minimum relative compaction should be 95 percent. Jetting of the native soil is not recommended.
- 8. Testing and Observation:** During grading, tests and observations should be performed by a representative of this firm to verify that the grading is performed per the project specifications. Density testing should be performed per the

current ASTM D1556 or ASTM D6938 test methods. The minimum acceptable degree of compaction should be 90 percent of the maximum dry density, based on ASTM D1557, except where superseded by more stringent requirements, such as beneath pavement. Where testing indicates insufficient density, additional compactive effort should be applied until retesting indicates satisfactory compaction.

LIMITATIONS

The findings and recommendations presented in this report are based on the soil conditions encountered at the boring locations. Should conditions be encountered during grading that appear to be different than those indicated by this report, this office should be notified.

This report was prepared for STK Architecture, Inc. for their use in the design of the proposed Fire Station No. 227. This report may only be used by STK Architecture, Inc for this purpose. The use of this report by parties or for other purposes is not authorized without written permission by Inland Foundation Engineering, Inc. Inland Foundation Engineering, Inc. will not be liable for any projects connected with the unauthorized use of this report.

The recommendations of this report are considered to be preliminary. The final design parameters may only be determined or confirmed at the completion of site grading on the basis of observations made during the site grading operation. To this extent, this report is not considered to be complete until the completion of both the design process and the site preparation.

The information in this report represents professional opinions that have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No warranty, express or implied, is made.

REFERENCES

American Concrete Institute 318 (2019), Building Code Requirements for Structural Concrete.

American Society of Civil Engineers (ASCE), 2017, Minimum Design Loads and Associated Criteria for Buildings and other Structures, ASCE Standard 7-16, 889pp.

California Building Standards Commission, 2022, California Building Code (CBC), California Code of Regulations, Title 24, Part 2, Volume 2.

County of San Bernardino (2013), Areawide Stormwater Program, Technical Guidance Document for Water Quality Management Plans

Terra Geosciences, Geologic Hazards Report, San Bernardino County Fire Station 227, NWC of 38th Street and Genevieve Avenue, City of San Bernardino, California, Project No. 244073-1, dated July 20, 2024

United States Geologic Survey, San Bernardino North 7.5' Quadrangle (2021)

NOT FOR BID

APPENDIX A

SITE EXPLORATION

Four exploratory borings were drilled at the approximate locations shown on Figure A-7. The materials encountered during drilling were logged by a staff geologist. Boring logs are included with this report as Figures A-3 through A-6.

Representative undisturbed soil samples were obtained within the borings by driving a modified California split spoon sampler and thin-walled steel penetration sampler. Representative bulk soil samples were also obtained from the excavation cuttings. Samples were placed in moisture sealed containers and transported to our laboratory for further testing and evaluation. Laboratory tests results are discussed and included in Appendix B.

NOT FOR BIDDING

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

PRIMARY DIVISIONS			GROUP SYMBOLS		SECONDARY DIVISIONS	
COARSE GRAINED SOILS MORE THAN HALF OF MATERIALS IS LARGER THAN #200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN) 5% FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
			GP		POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVEL WITH FINES	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN) 5% FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
			SP		POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
		SANDS WITH FINES	SM		SILTY SANDS, SAND-SILT MIXTURES	
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES	
FINE GRAINED SOILS MORE THAN HALF OF MATERIALS IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50		ML		INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
			OL		ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	HIGHLY ORGANIC SOILS		PT		PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS	
TYPICAL FORMATIONAL MATERIALS	SANDSTONES		SS			
	SILTSTONES		SH			
	CLAYSTONES		CS			
	LIMESTONES		LS			
	SHALE		SL			

CONSISTENCY CRITERIA BASES ON FIELD TESTS

RELATIVE DENSITY – COARSE – GRAIN SOIL			CONSISTENCY – FINE-GRAIN SOIL		TORVANE	POCKET ** PENETROMETER	* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM -1586 STANDARD PENETRATION TEST)
RELATIVE DENSITY	SPT * (# BLOWS/FT)	RELATIVE DENSITY (%)	CONSISTENCY	SPT* (# BLOWS/FT)	UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	
VERY LOOSE	<4	0-15	Very Soft	<2	<0.13	<0.25	
LOOSE	4-10	15-35	Soft	2-4	0.13-0.25	0.25-0.5	
MEDIUM DENSE	10-30	35-65	Medium Stiff	4-8	0.25-0.5	0.5-1.0	
DENSE	30-50	65-85	Stiff	8-15	0.5-1.0	1.0-2.0	
VERY DENSE	>50	85-100	Very Stiff	15-30	1.0-2.0	2.0-4.0	** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ.FT. READ FROM POCKET PENETROMETER
			Hard	>30	>2.0	>4.0	

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbled or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

EXPLANATION OF LOGS

LOG OF BORING B-01

DRILLING RIG Mobile B-61
 DRILLING METHOD Rotary Auger
 LOGGED BY FWC
 GROUND ELEVATION +/-

DATE DRILLED 7/11/24

HAMMER TYPE Auto-Trip
 HAMMER WEIGHT 140-lb.
 HAMMER DROP 30-inches
 BORING DIAMETER 8-inches

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
			This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.						
	SM		GRASS, SILTY SAND, with trace gravel, fine to very coarse, very dark grayish-brown (10YR 3/2), moist, medium dense.			AU			
5	SP-SM		SAND with SILT and GRAVEL, fine to very coarse, gray-brown (2.5Y 5/2), slightly moist, medium dense.			SS AU	9 9	11	112
	SM		SILTY SAND, with trace gravel, fine to very coarse, very dark grayish-brown (10YR 3/2), moist, medium dense.			SS	6 11	6	93
10	SW-SM		SAND with SILT and GRAVEL, fine to coarse, grayish-brown (10YR 5/2), slightly moist, medium dense.			SS AU	8 13	5	113
15	SW-SM					SS	23 18	2	130
	SC-SM		SILTY, CLAYEY SAND, very fine to fine, olive-brown (2.5Y 4/4), moist, medium dense.			SS	9 10	12	117
20	SW-SM		SAND with SILT and GRAVEL, fine to very coarse, light olive-brown (2.5Y 5/4), slightly moist, medium dense.			SS	18 25	5	114
25	SM		SILTY SAND, with trace gravel, very fine to fine, grayish-brown (2.5Y 5/2), moist, dense.			SPT	33 28	10	
	SW-SM		SAND with SILT and GRAVEL, fine to very coarse, gray-brown (2.5Y 5/2), slightly moist, medium dense.						
30			COBBLES and BOULDERS, End of boring at 30.8 feet. No groundwater encountered. Backfilled with native soil.			SPT	30 50/3"	2	



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FIGURE NO.

A-3

LOG OF BORING B-02

DRILLING RIG Mobile B-61
 DRILLING METHOD Rotary Auger
 LOGGED BY FWC
 GROUND ELEVATION +/-

DATE DRILLED 7/11/24

HAMMER TYPE Auto-Trip
 HAMMER WEIGHT 140-lb.
 HAMMER DROP 30-inches
 BORING DIAMETER 8-inches

SUMMARY OF SUBSURFACE CONDITIONS									
DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
			<u>GRASS.</u>						
5	SM		<u>SILTY SAND</u> , with trace gravel, fine to medium, dark grayish-brown (10YR 5/2), moist, loose.	⊗	SS	6 6	5	109	
			⊗	SS	4 5	9	106		
10	SM		<u>SILTY SAND</u> , with trace gravel, fine to medium, light olive-brown (2.5Y 5/2), slightly moist, medium dense.	⊗	SS	8 12	3	109	
15	SP-SM		<u>SAND with SILT</u> , fine to coarse, dark grayish-brown (10YR 4/2), moist, loose to medium dense.	⊗	SS	6 8	8	110	
			⊗	SS	12 14	6	107		
20	SW-SM		<u>SAND with SILT and GRAVEL</u> , fine to medium, grayish-brown (10YR 5/2), slightly moist, medium dense.	⊗	SS	17 24	3	117	
25			⊗	SPT	13 19	5			
30		GW	<u>GRAVEL with SAND</u> , fine to coarse, olive-gray (5Y 4/2), moist, dense.	⊗	SPT	35 50	3		
35		<u>SAND with SILT and GRAVEL</u> , fine to medium, olive-gray (5Y 5/2), slightly moist, dense.	⊗	SPT	50	2			
40			⊗	SPT	50/5"	3			
45			⊗	SPT	31 50	3			
50			⊗	SPT	50/5"	7			
			End of boring at 50.5 feet. No groundwater encountered. Backfilled with native soil.						



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FIGURE NO.

A-4

LOG OF BORING B-03

DRILLING RIG Mobile B-61
 DRILLING METHOD Rotary Auger
 LOGGED BY FWC
 GROUND ELEVATION +/-

DATE DRILLED 7/11/24

HAMMER TYPE Auto-Trip
 HAMMER WEIGHT 140-lb.
 HAMMER DROP 30-inches
 BORING DIAMETER 8-inches

SUMMARY OF SUBSURFACE CONDITIONS									
DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
5	SM		<u>GRASS,</u> <u>SILTY SAND,</u> fine to medium, dark grayish-brown (2.5Y 4/2), slightly moist, loose.			AU			
			- rootlets throughout -			SS	3 6	4	107
						SS	3 8	7	111
						AU			
10	SP-SM		<u>SAND with SILT and GRAVEL,</u> fine to coarse, light olive-brown (2.5Y 5/3), slightly moist, medium dense.			SS	8 11	3	108
						SS	12 25	4	116
15	SM SW-SM SM		<u>SILTY SAND,</u> fine to coarse, brown (10YR 4/2), moist, medium dense.						
			<u>SAND with SILT and GRAVEL,</u> fine to coarse, light olive-brown (2.5Y 5/3), slightly moist, medium dense.						
			<u>SILTY SAND with GRAVEL,</u> fine to medium, light olive-brown (2.5Y 5/3), slightly moist, medium dense.			SS	10 14	5	113
			<u>SAND with SILT and GRAVEL,</u> fine to coarse, OLIVE-GRAY (5y 4/2), slightly moist, medium dense.						
20	SW-SM								
			End of boring at 21.5 feet. No groundwater encountered. Backfilled with native soil.						



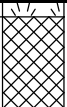
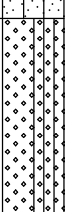
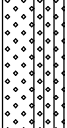
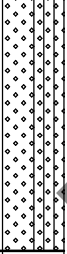
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FIGURE NO.

A-5

LOG OF BORING B-04

DRILLING RIG	<u>Mobile B-61</u>	DATE DRILLED	<u>7/11/24</u>	HAMMER TYPE	<u>Auto-Trip</u>
DRILLING METHOD	<u>Rotary Auger</u>	HAMMER WEIGHT	<u>140-lb.</u>	HAMMER DROP	<u>30-inches</u>
LOGGED BY	<u>FWC</u>	BORING DIAMETER	<u>8-inches</u>		
GROUND ELEVATION	<u>+/-</u>				

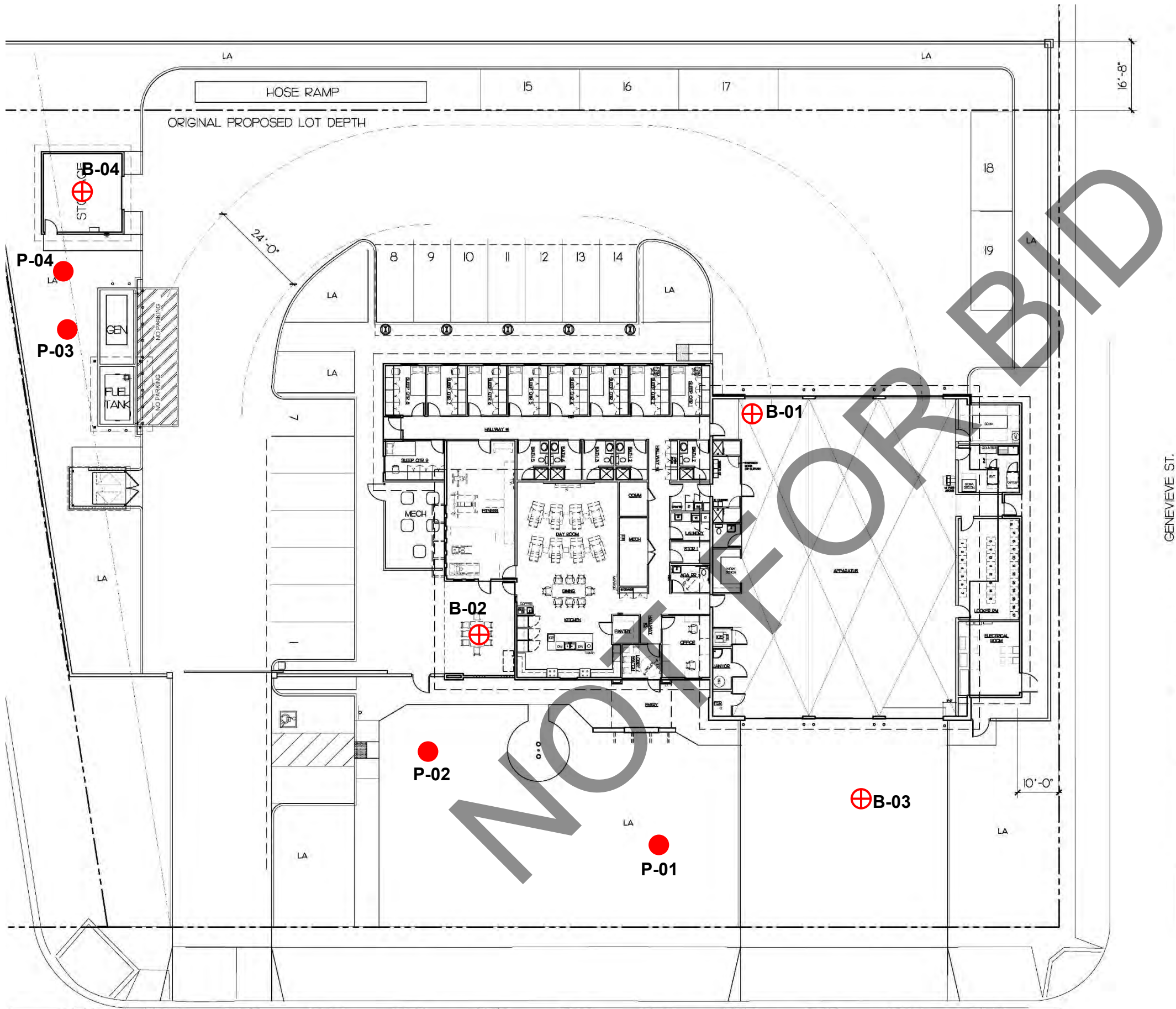
SUMMARY OF SUBSURFACE CONDITIONS									
DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
	SM		<u>GRASS,</u> <u>ARTIFICIAL FILL,</u> SILTY SAND, with trace gravel, fine to medium, grayish-brown (10YR 5/2), slightly moist, medium dense.			AU			
	SM		<u>SILTY SAND,</u> fine to coarse, grayish-brown (10YR 5/2), slightly moist, medium dense.			SS AU	16 18	3	110
5	SW-SM		<u>SAND with SILT and GRAVEL,</u> with trace gravel, fine to coarse, light olive-brown 2.5Y 5/4), slightly moist, medium dense.			SS	10 14	3	115
	SW-SM					SS	8 8	6	102
10	GW		<u>GRAVEL with SAND,</u> fine to coarse, light olive-brown (2.5Y 5/4), slightly moist, medium dense.			SS	11 14	3	115
	SW-SM		<u>SAND with SILT and GRAVEL,</u> with trace gravel, fine to coarse, light olive-brown 2.5Y 5/4), slightly moist, medium dense.						
15	SW-SM					SS	22 31	4	
			End of boring at 16.5 feet. No groundwater encountered. Backfilled with native soil.						



CLIENT	<u>STK Architecture, Inc.</u>
PROJECT NAME	<u>Fire Station #227</u>
PROJECT LOCATION	<u>NWC Genevieve St. & W. 38th St.</u> <u>San Bernardino, CA</u>
PROJECT NUMBER	<u>S168-193</u>

FIGURE NO.

A-6



SITE PLAN
STK Architecture, Inc.
Proposed Fire Station 227
NWC Genevieve Street N. and W. 38th Street
San Bernardino County, California

- LEGEND**
- Approximate Location of Exploratory Boring - ⊕
 - Approximate Location of Percolation Test - ●

Base Map: Prepared by STK Architecture, Inc.



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Inland Foundation Engineering, Inc.
1310 S. Santa Fe Avenue, San Jacinto, CA 92583 | (951) 654-1555

Figure A-7	STK Architecture, Inc. Proposed Fire Station 227 San Bernardino County, California	
	Drawn By: HR	Project No. S168-193
	Not to Scale	Date: August 2024

***APPENDIX B –
Laboratory Testing***

NOT FOR BID

APPENDIX B

LABORATORY TESTING

Representative soil samples obtained from our borings were delivered to our laboratory. Descriptions of the tests performed are provided below. Results of the testing are appended.

Unit Weight and Moisture Content: Ring samples were weighed and measured to evaluate their unit weight. A small portion of each sample was then tested for moisture content. The testing was performed per ASTM D2937 and D2216. The results of this testing are shown on the boring logs (Figures A-3 through A-6).

Maximum Density-Optimum Moisture: One sample was selected for maximum density testing in accordance with ASTM D1557. The maximum density is compared to the in-situ density of the soil to evaluate the relative compaction of the soil. The results of the testing are shown on Figure B-3.

Sieve Analysis: Ten soil samples were selected for sieve analysis testing in accordance with ASTM D6913. These tests provide information for classifying the soil in accordance with the Unified Classification System. This classification system categorizes the soil into groups having similar engineering characteristics. The results of the testing are shown on Figures B-4 and B-5.

Plastic Index: Two samples were selected for plastic index testing in accordance with ASTM D4318. These tests provide information regarding soil plasticity and are also used for developing classifications for the soil in accordance with the Unified Classification System. The results of the testing are shown on Figures B-4 and B-5.

Consolidation Testing: Two samples were selected for consolidation testing in accordance with ASTM D2435. This test is used to evaluate the magnitude and rate of settlement of a structure or earth fill. The results of this testing are presented graphically on Figure B-6.

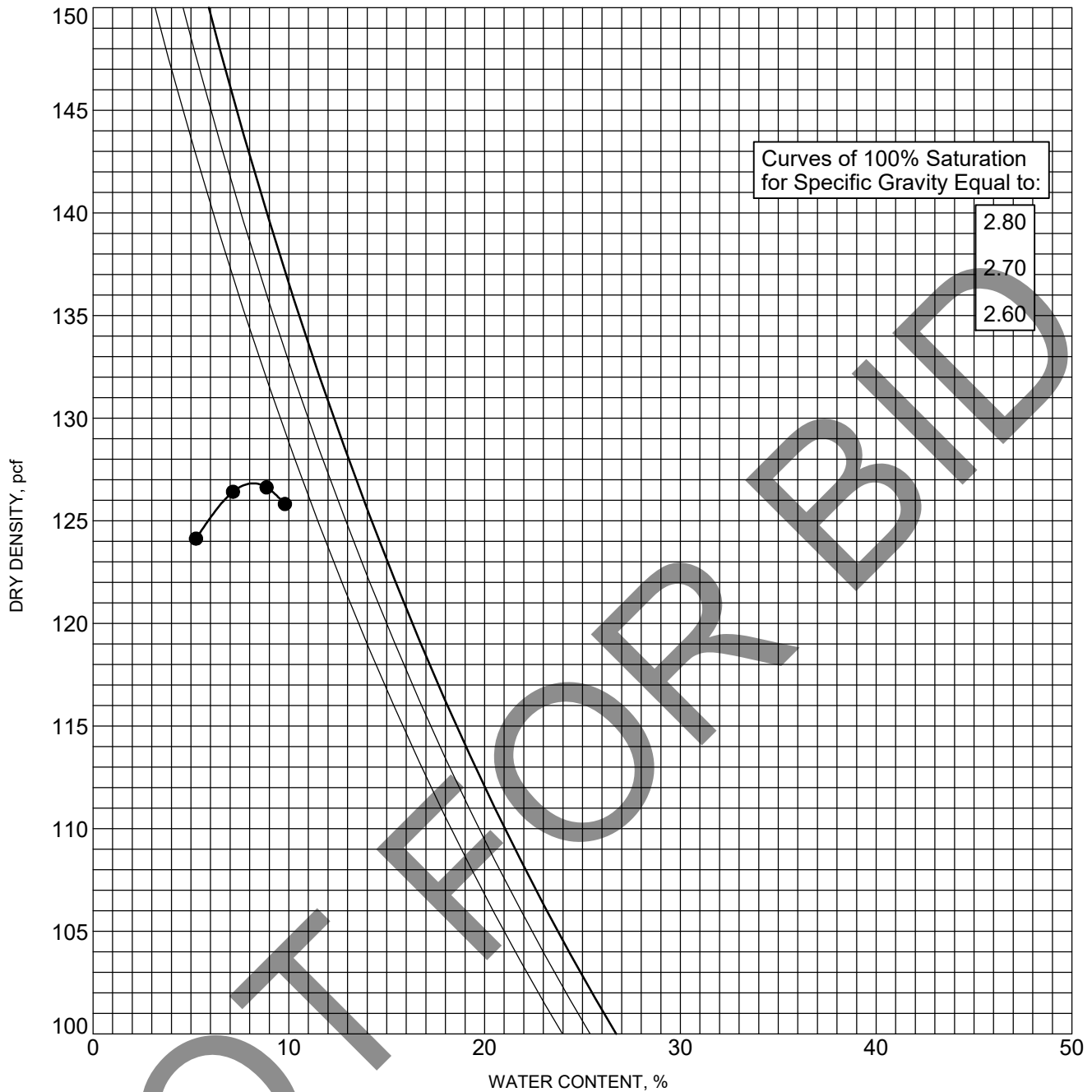
Direct Shear Strength: Two samples were selected and transported to AP Engineering and Testing in Pomona, California for direct shear strength testing in accordance with ASTM D3080. This testing measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation bearing capacity and lateral earth pressure. Test results are shown on Figures B-7 and B-8.

Corrosion Testing: One sample was selected and transported to AP Engineering and Testing in Pomona, California to evaluate the concentration of soluble sulfates and chlorides, pH level, and resistivity of and within the on-site soils. The test results are shown on Figure B-9.

R-value: One sample was selected for R-value and delivered to Terracon in Colton, California for testing in accordance with ASTM D2844. This test measures the potential strength of subgrade, subbase, and base course materials for use in pavements. Test results are shown on Figure No. B-10.

NOT FOR BID

IFE COMPACTION - GINT STD US LAB.GDT - 8/20/24 15:31 - P:\S168\S168-193 SB FS 227\GINT.GPJ



BOREHOLE	DEPTH	Description of Materials	Max DD	Optimum WC
● B-01	0.0	SILTY SAND with GRAVEL(SM)	126.8 PCF	8.1 %

MOISTURE-DENSITY CURVES (ASTM D1557)

INLAND FOUNDATION ENGINEERING, INC.

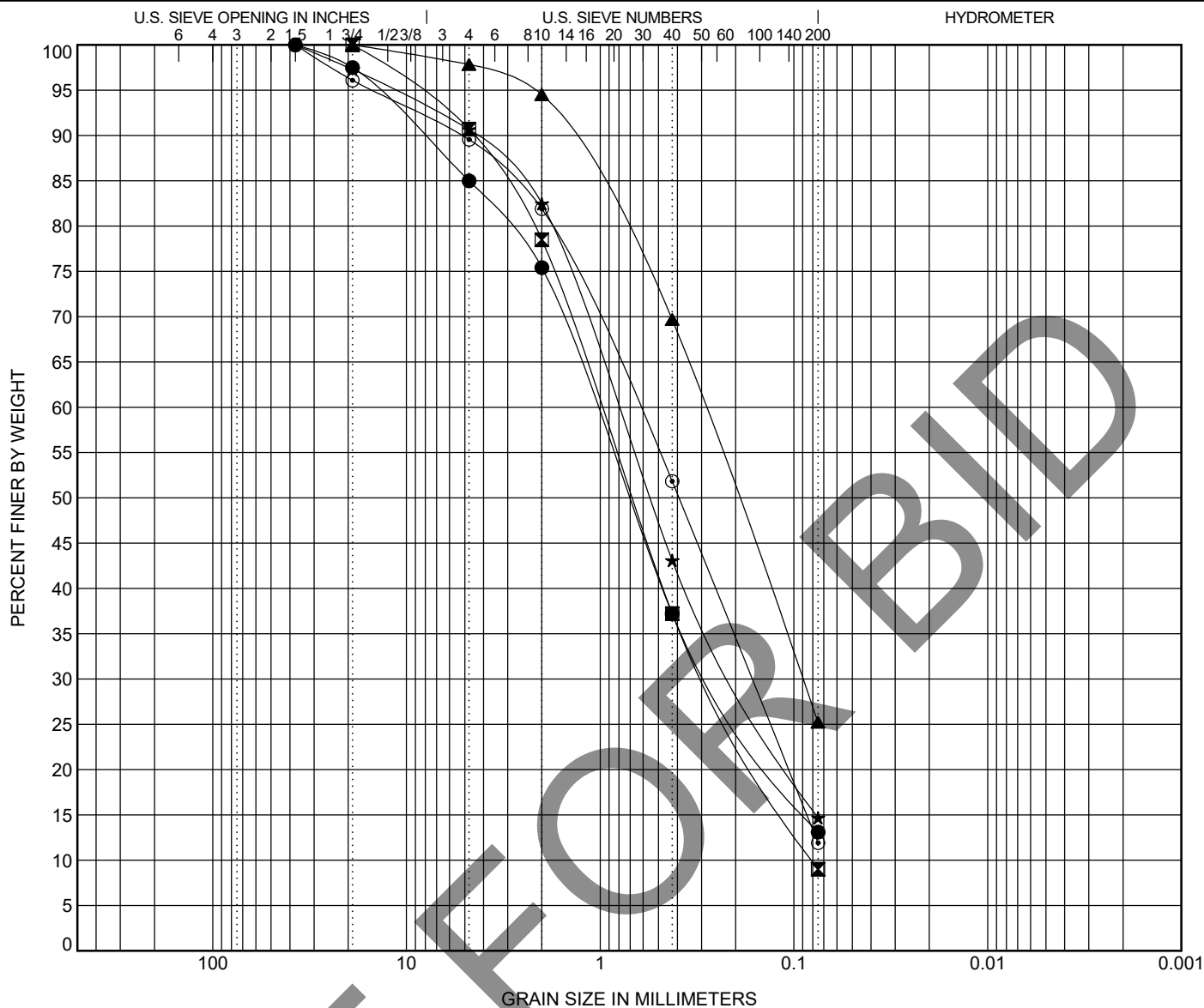
FIGURE NO. B-3

CLIENT STK Architecture, Inc. **PROJECT NAME** Fire Station #227

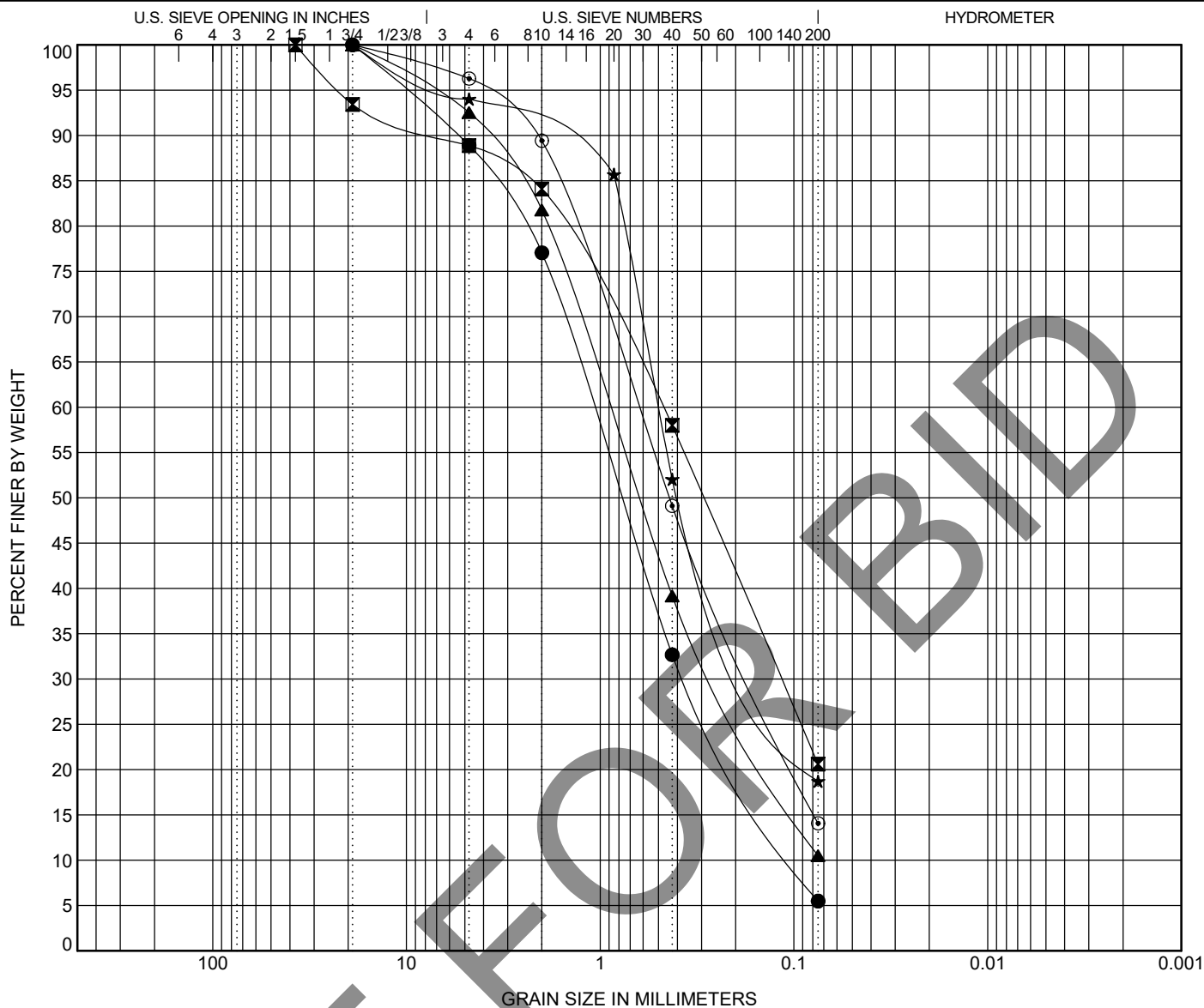
PROJECT NUMBER S168-193 **PROJECT LOCATION** NWC Genevieve St. & W. 38th St.

San Bernardino, CA

IFE SIEVE ANALYSIS - GINT STD US LAB.GDT - 8/20/24 15:29 - P:\S168\S168-193 SB FS 227\GINT.GPJ



IFE SIEVE ANALYSIS - GINT STD US LAB.GDT - 8/20/24 15:29 - P:\S168\S168-193 SB FS 227\GINT.GPJ



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

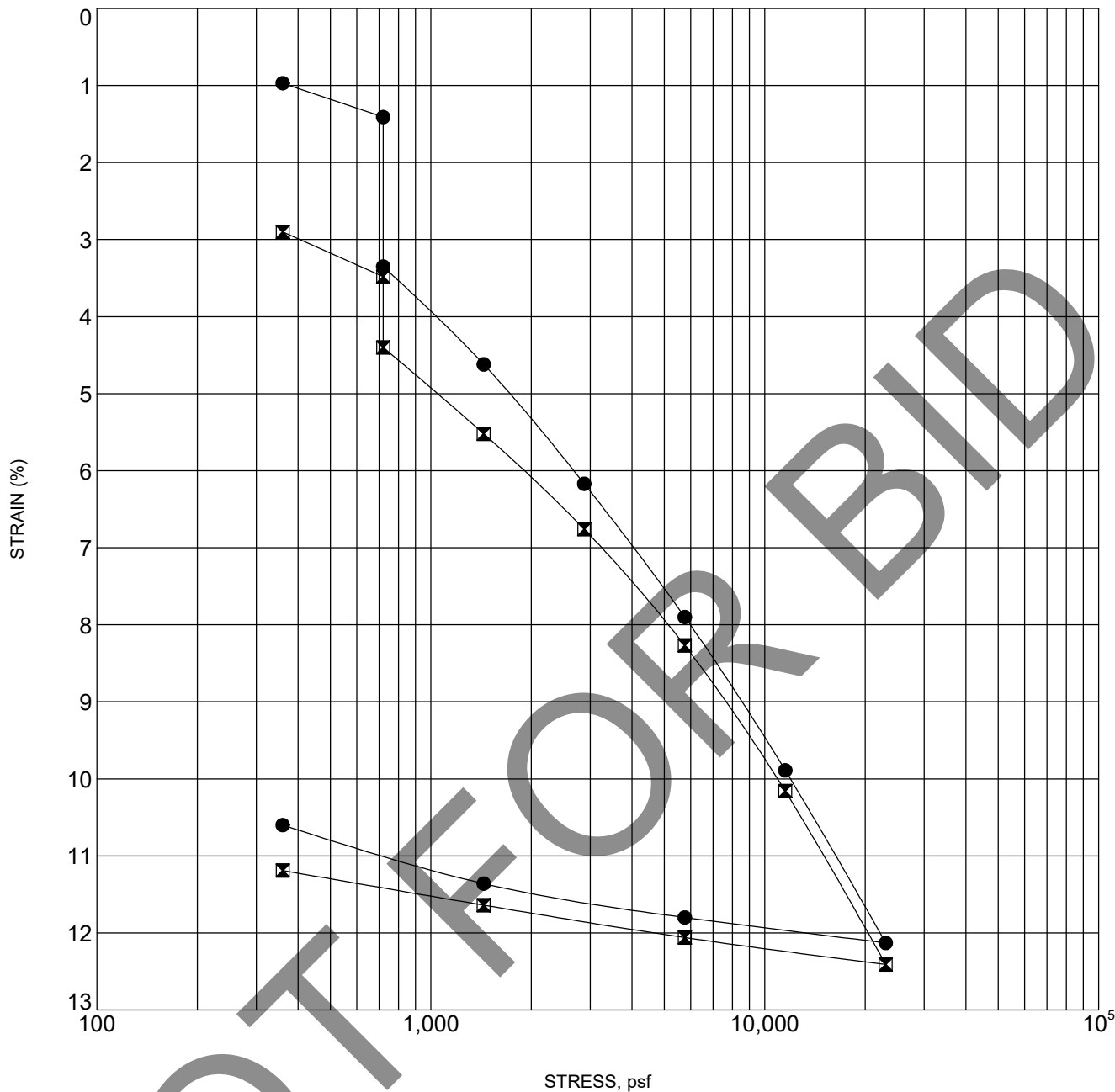
SAMPLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-02	20.5	WELL-GRADED SAND with SILT(SW-SM)					NP	NP	NP	1.16	11.03
⊠ B-03	0.3	SILTY SAND(SM)					NP	NP	NP		
▲ B-03	7.8	POORLY GRADED SAND with SILT(SP-SM)					NP	NP	NP	0.90	12.46
★ B-04	0.3	SILTY SAND(SM)					NP	NP	NP		
⊙ B-04	2.0	SILTY SAND(SM)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D90	D50	D10	%Gravel	%Sand	%Silt		%Clay	
● B-02	20.5	19	5.451	0.778	0.1	11.1	83.4	5.5			
⊠ B-03	0.3	37.5	6.699	0.293		11.1	68.2	20.6			
▲ B-03	7.8	19	3.874	0.63		7.5	82.0	10.5			
★ B-04	0.3	19	2.069	0.382		6.0	75.3	18.7			
⊙ B-04	2.0	19	2.151	0.44		3.7	82.2	14.1			

GRADATION CURVES (ASTM D6913, ASTM D4318)

INLAND FOUNDATION ENGINEERING, INC.

FIGURE NO. B-5

CLIENT	STK Architecture, Inc.	PROJECT NAME	Fire Station #227
PROJECT NUMBER	S168-193	PROJECT LOCATION	NWC Genevieve St. & W. 38th St.
			San Bernardino, CA



BOREHOLE	DEPTH	Classification	γ_d	MC%
● B-02	6.5			
✕ B-03	5.5			

CONSOLIDATION TEST (ASTM D2435)

INLAND FOUNDATION ENGINEERING, INC.

FIGURE NO. B-6

CLIENT	<u>STK Architecture, Inc.</u>	PROJECT NAME	<u>Fire Station #227</u>
PROJECT NUMBER	<u>S168-193</u>	PROJECT LOCATION	<u>NWC Genevieve St. & W. 38th St.</u>
			<u>San Bernardino, CA</u>



DIRECT SHEAR TEST RESULTS ASTM D 3080

Project Name: STK - Fire Station 227
Project No.: 5163-193
Boring No.: B-02
Sample No.: - Depth (ft): 3.5-4.5
Sample Type: Mod. Cal.
Soil Description: Silty Sand
Test Condition: Inundated Shear Type: Regular

Tested By: ST Date: 08/02/24
Computed By: JP Date: 08/07/24
Checked by: AP Date: 08/07/24

Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Initial Degree Saturation (%)	Final Degree Saturation (%)	Normal Stress (ksf)	Peak Shear Stress (ksf)	Ultimate Shear Stress (ksf)
110.0	106.4	3.4	19.3	16	89	1	0.744	0.684
						2	1.476	1.380
						3	2.148	1.956

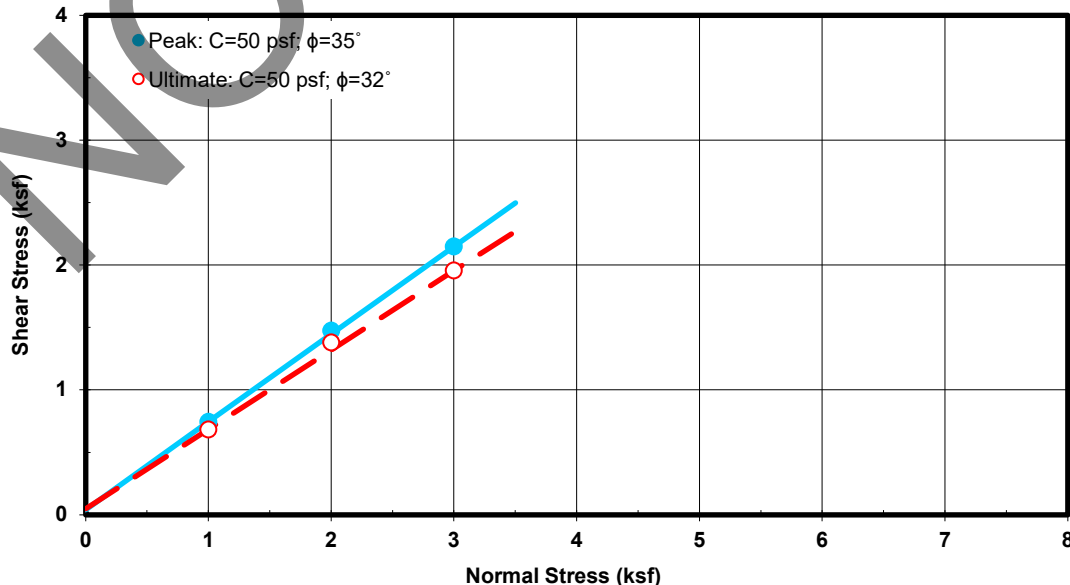
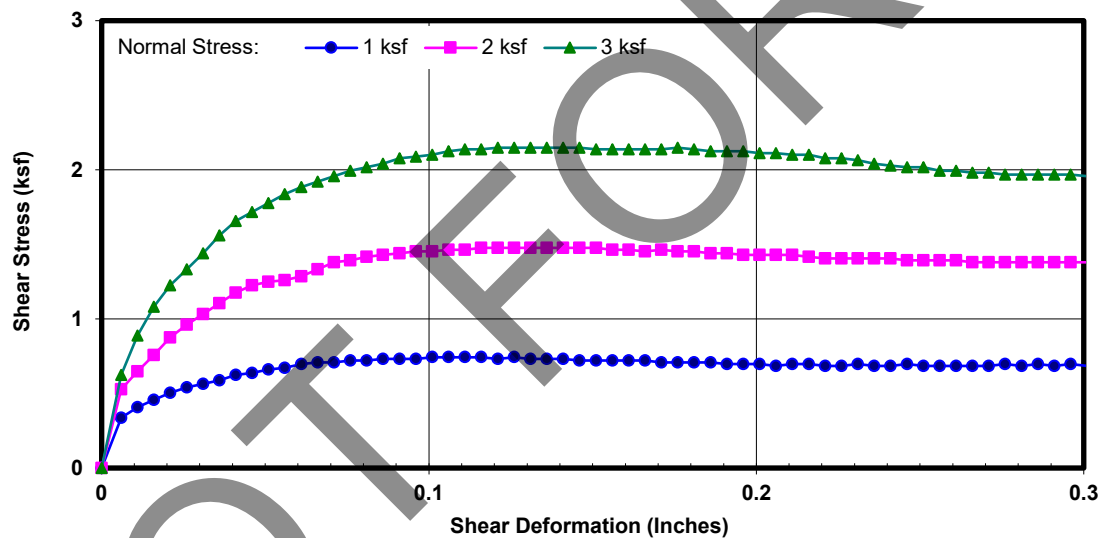


Figure No. B-7

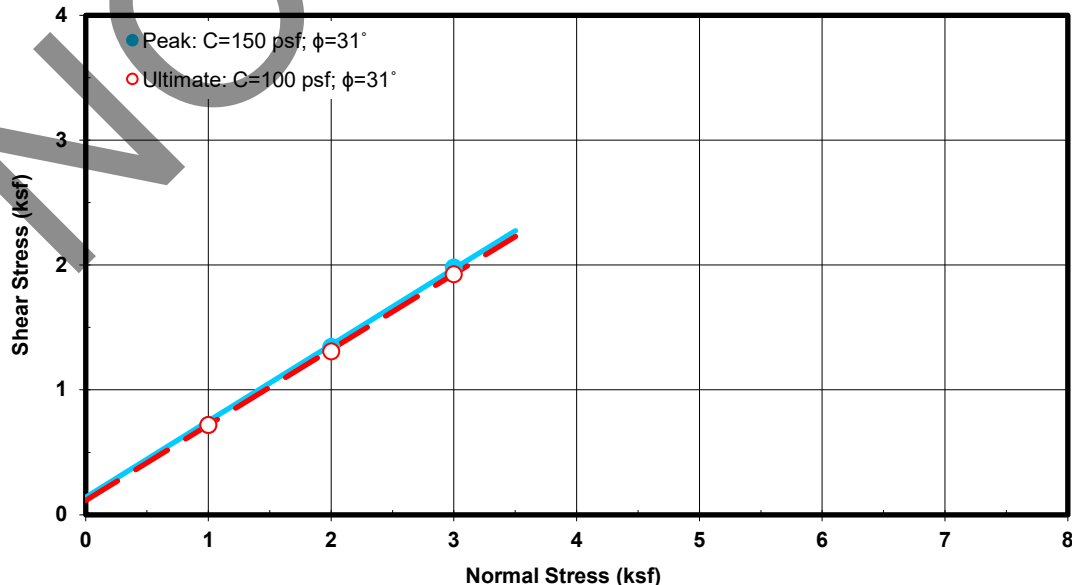
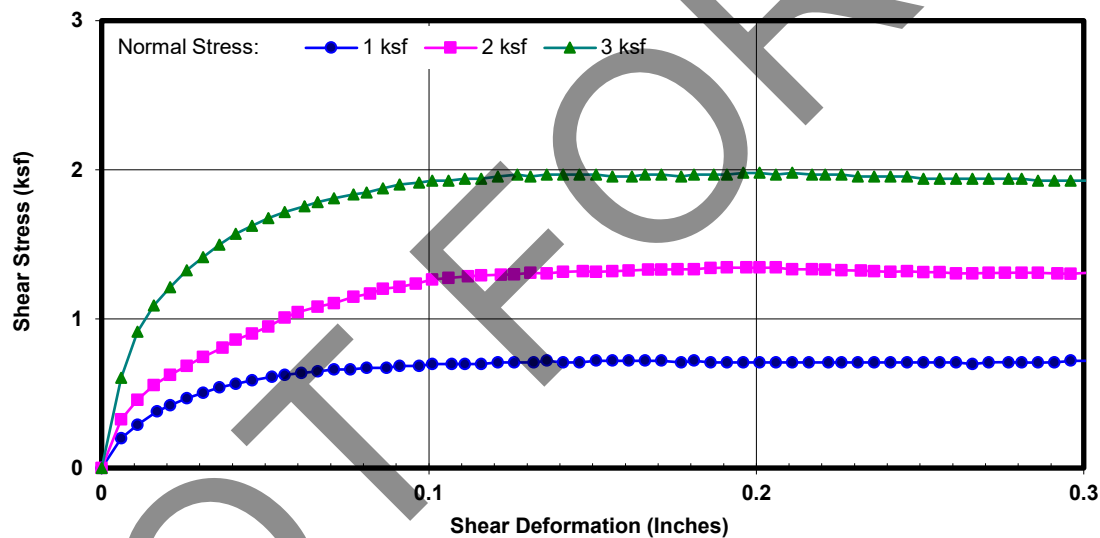


DIRECT SHEAR TEST RESULTS ASTM D 3080

Project Name: STK - Fire Station 227
Project No.: 5163-193
Boring No.: B-03
Sample No.: - Depth (ft): 2.5-3.5
Sample Type: Mod. Cal.
Soil Description: Silty Sand
Test Condition: Inundated Shear Type: Regular

Tested By: ST Date: 08/02/24
Computed By: JP Date: 08/07/24
Checked by: AP Date: 08/07/24

Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Initial Degree Saturation (%)	Final Degree Saturation (%)	Normal Stress (ksf)	Peak Shear Stress (ksf)	Ultimate Shear Stress (ksf)
106.1	102.4	3.6	21.0	15	88	1	0.720	0.720
						2	1.344	1.308
						3	1.980	1.927



**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com**CORROSION TEST RESULTS**Client Name: Inland Foundation EngineeringAP Job No.: 24-0764Project Name: STK - Fire Station 227Date: 08/01/24Project No.: 5163-193

Boring No.	Sample No.	Depth (feet)	Soil Description	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B-01	-	0-4.5	Silty Sand w/gravel	7,790	8.5	52	30

NOTES:

Resistivity Test and pH: California Test Method 643

Sulfate Content : California Test Method 417

Chloride Content : California Test Method 422

ND = Not Detectable

NA = Not Sufficient Sample

NR = Not Requested

Job No. CB191148
Date. 8/8/2024

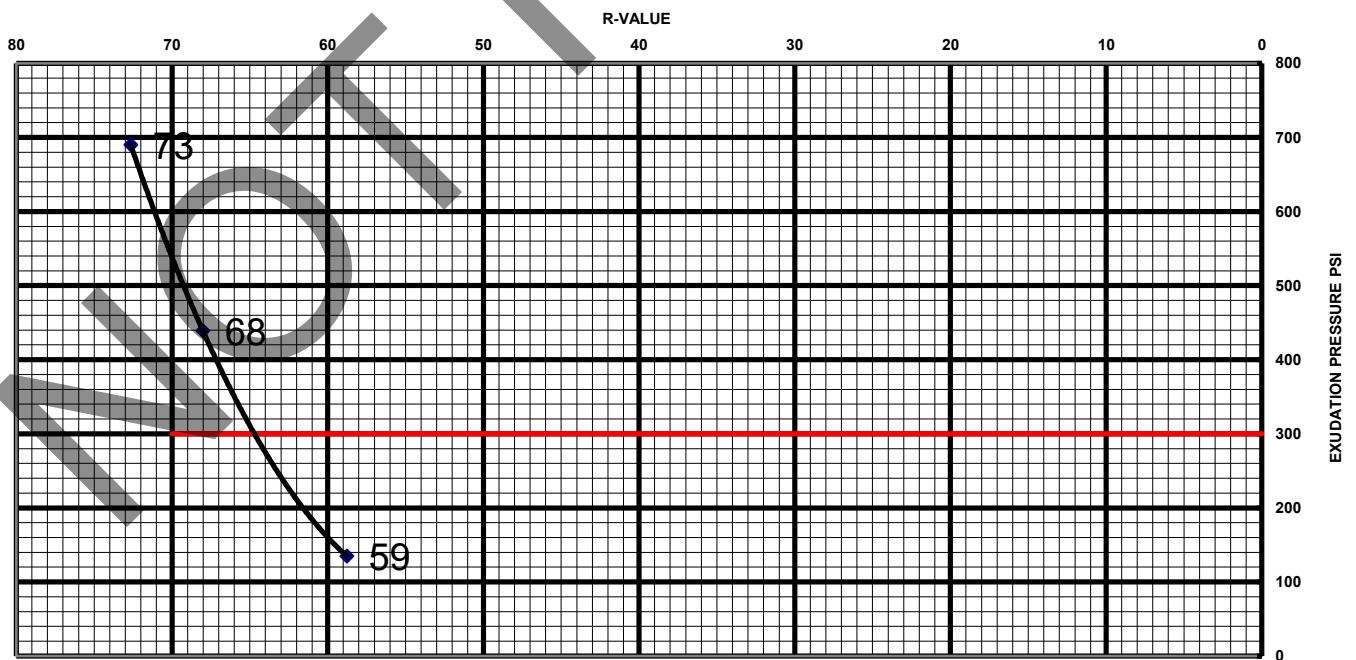
**LABORATORY RECORD OF TESTS MADE ON
BASE, SUBBASE, AND BASEMENT SOILS**

CLIENT: Inland Foundation Engineering
PROJECT STK-Fire Station 227 S168-193
LOCATION:
R-VALUE # : B-03
T.I. :

COMPACTOR AIR PRESSURE P.S.I.
INITIAL MOISTURE %
WATER ADDED, ML
WATER ADDED %
MOISTURE AT COMPACTION %
HEIGHT OF BRIQUETTE
WET WEIGHT OF BRIQUETTE
DENSITY LB. PER CU.FT.
STABILOMETER PH AT 1000 LBS.
2000 LBS.
DISPLACEMENT
R-VALUE
EXUDATION PRESSURE
THICK. INDICATED BY STAB.
EXPANSION PRESSURE
THICK. INDICATED BY E.P.

A	B	C	D
350	350	350	
3.7	3.7	3.7	
70	60	50	
6.6	5.6	4.7	
10.3	9.3	8.4	
2.48	2.50	2.50	
1106	1107	1106	
122.6	122.7	123.7	
23	18	16	
38	29	26	
5.63	5.31	4.85	
59	68	73	
135	439	690	
0.00	0.00	0.00	
0	0	0	
0.00	0.00	0.00	

EXUDATION CHART



R-Value: 64

Figure B-10

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APPENDIX C

INFILTRATION TESTING

Infiltration testing was conducted in general accordance with Appendix D of the Technical Guidance Document for Water Quality Management Plans for the County of San Bernardino Areawide Stormwater Program (2013). The shallow percolation test method was used per the Riverside County Department of Environmental Health guidelines. The percolation rates were converted to infiltration rates using the Porchet method.

Four percolation tests were performed at the locations shown on Figure A-2. The test holes were drilled on July 11, 2024 to depths of approximately 4 and 5 feet below existing ground surface. The test holes were approximately eight (8) inches in diameter. Gravel was placed in the bottom of each test hole. The test holes were then pre-soaked by filling to ground surface (at least 5 times the hole radius).

Testing was conducted 24 hours after the pre-soak on January 5, 2023. All pre-soak water had percolated through the test holes. For all tests, more than 6 inches of water seeped away twice consecutively in less than 25 minutes, which meets the sandy soil criteria. The tests were then run for an additional hour with measurements taken every 10 minutes.

The water percolated through all test holes within all 10-minute test intervals. The percolation rates were calculated to range from 1.0 to 2.5 minutes per inch (mpi). The percolation test rate was converted to an infiltration rate (I_c) using the Porchet method and the following equation:

$$I_c = \Delta H 60r / \Delta t (r + 2H_{avg})$$

Where:

r = Test Hole Radius (in.)

H_{avg} = Average Height of Water during Test Interval (in.)

ΔH = Change in Water Height during Test Interval (in.), and

Δt = Time Interval (in.)

The corresponding calculated infiltration rates (I_c) ranged from 2.0 to 5.7 inches per hour. Copies of the field test sheets are included with this report as Figures C-2 through C-5.

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-01				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 60"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	6:59	7:24	25	31	58	27	Y		
2	7:25	7:50	25	36	58	22	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div 2$	I_T $\frac{\Delta H \ 60r}{\Delta t(r+2H)}$ Avg
1	7:51	8:01	10	36	51	15	.67	16.5	9.7
2	8:02	8:12	10	36	48.5	12.5	.80	17.8	7.6
3	8:13	8:23	10	36	47	11	.91	18.5	6.4
4	8:24	8:34	10	36	46	10	1.0	19	5.7
5	8:35	8:45	10	36	46	10	1.0	19	5.7
6	8:47	8:57	10	36	46	10	1.0	19	5.7
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Overcast (75°)									

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-02				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 48"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	7:03	7:28	25	24	46	22	Y		
2	7:29	7:54	25	24	45.5	21.5	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div$ 2	I_T $\frac{\Delta H 60r}{\Delta t(r+2H)}$ Avg
1	8:59	9:09	10	24	36	12	.83	18	7.2
2	9:10	9:20	10	24	34.5	11.5	.87	18.8	6.0
3	9:20	9:30	10	24	34.5	11.5	.87	18.8	6.0
4	9:31	9:41	10	24	34	10	1.0	19	5.7
5	9:42	9:52	10	24	34	10	1.0	19	5.7
6	9:53	10:03	10	24	34	10	1.0	19	5.7
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Overcast (77°F)									

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-03				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 60"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"				Sides (if rectangular) =					
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	7:06	7:31	25	35	46	11	Y		
2	7:32	7:57	25	36	45	9	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div 2$	I_T $\frac{\Delta H \ 60r}{\Delta t(r+2H)}$ Avg
1	10:04	10:14	10	36	40	4	2.5	22	2.0
2	10:15	10:25	10	36	40	4	2.5	22	2.0
3	10:26	10:36	10	36	40	4	2.5	22	2.0
4	10:37	10:47	10	36	40	4	2.5	22	2.0
5	10:48	10:58	10	36	40	4	2.5	22	2.0
6	10:59	11:09	10	36	40	4	2.5	22	2.0
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Partly Cloudy (83°F)									

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-04				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 48"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	7:07	7:32	25	24	46	22	Y		
2	7:33	7:58	25	24	45	21	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div 2$	I_T $\frac{\Delta H 60r}{\Delta t(r+2H)}$ Avg
1	11:09	11:19	10	24	36	12	.83	18	7.2
2	11:20	11:30	10	24	35	11	.91	18.5	6.4
3	11:31	11:41	10	24	34.5	10.5	.95	18.8	6.0
4	11:42	11:52	10	24	34	10	1.0	19	5.7
5	11:53	12:03	10	24	34	10	1.0	19	5.7
6	12:04	12:14	10	24	34	10	1.0	19	5.7
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Partly cloudy (89°F)									

**APPENDIX D –
Liquefaction and Seismic
Settlement Analysis**

NOT FOR BID

APPENDIX D

LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSIS

Liquefaction and seismic settlement potential were evaluated using the GeoSuite® computer program (version 3.2.1.6). The seismic parameters included a horizontal acceleration of 0.95g and a Moment Magnitude of 8.1. We analyzed the soil profile logged for exploratory boring B-02. The GeoSuite® program calculates corrected normalized SPT N-values $(N_1)_{60}$ using the following formula (SCEC, 1999).

$$(N_1)_{60} = N_M C_N C_E C_B C_R C_S$$

Where; N_M = measured standard penetration resistance. Modified California sample blowcounts were converted to SPT blowcounts using Burmister's formula (1948) prior to input in the program. The modified California sample blowcounts were also corrected to account for lined samplers, as described in the C_S factor discussion below.

C_N = depth correction factor. GeoSuite® calculates C_N for each layer in the soil profile using the relationship suggested by Idriss and Boulanger (2008)

C_E = hammer energy ratio (ER) correction factor. A C_E factor of 1.3 was applied for the automatic trip hammer used during drilling and was calculated using the relationship suggested by Idriss and Boulanger (2008).

C_B = borehole diameter correction factor. A C_B factor of 1.0 was applied for the 8-inch diameter hollow-stem augers with inside diameters of four (4) inches (SCEC 1999).

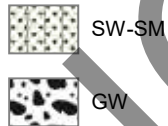
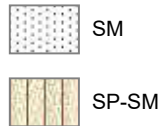
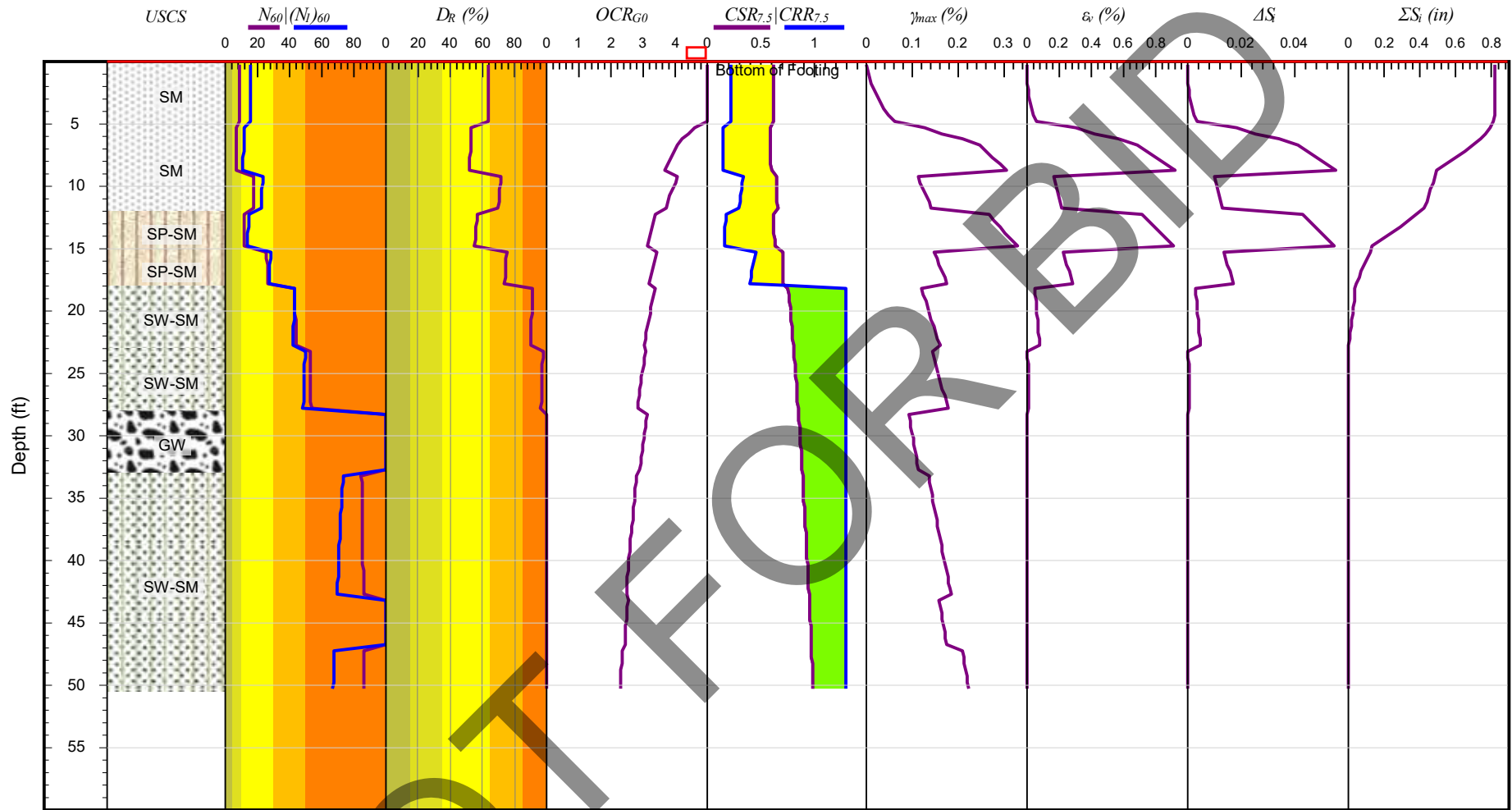
C_R = rod length correction factor. GeoSuite® applies a C_R factor for each layer in the soil profile using the values in Table 5.2 of the 1999 SCEC guidelines, and assuming a rod stick up length (above the ground surface) of 3 feet.

C_S = correction factor for samplers with or without liners. SPT samplers without liners were used for this project. For SPT samplers without liners, GeoSuite® applies a C_S factor for each layer in the soil profile using the relationships from Seed et al. (1984) and suggested by Idriss and Boulanger (2008). Since GeoSuite® applies a C_S factor to all layers in the soil profile, it is necessary to adjust blowcounts for modified California samplers with liners.

This was done through an iterative process by initially dividing the modified California sampler blowcounts by an assumed C_S value of 1.2 prior to input in the program.

Calculated C_S values were then checked against the assumed values and adjusted where necessary, so that the actual applied C_S value for modified California samples is 1.0.

The results of the analysis are shown on Figure D-2.



Silt Correction:
UCLA method

Earthquake & Groundwater Information:
Magnitude = 8.1
Max. Acceleration = 0.95 g
Project GW = 100 ft
Maximum Settlement = 0.82 in
Settl. at Bottom of Footing = 0.82 in

Liquefaction: Boulanger & Idriss (2010-16)
Settl.: [dry] Yi (2022)
Lateral spreading: Idriss & Boulanger (2008)
M correction: [Sand] Boulanger & Idriss (2004)
 σ_v correction: Idriss & Boulanger (2008)
Stress reduction: Idriss & Boulanger (2008)



Seismic Settlement Potential - SPT Data

Project:	Fire Station 227				
Location:	Genevieve and 38th				
Project No.:	S168-193	Boring No.:	B-02	Figure: D-2	0

NOT FOR BID



GEOLOGIC HAZARDS REPORT
SAN BERNARDINO COUNTY FIRE STATION 227
NWC OF 38TH STREET AND GENEVIEVE AVENUE
CITY OF SAN BERNARDINO, CALIFORNIA

Project No. 244073-1

July 20, 2024

Prepared for:

Inland Foundation Engineering, Inc.
1310 South Santa Fe Avenue
San Jacinto, CA 92583

Inland Foundation Engineering, Inc.
1310 South Santa Fe Avenue
San Jacinto, CA 92583

Attention: Mr. Allen Evans, P.E., G.E., Principal

Regarding: Geologic Hazards Report
San Bernardino County Fire Station 227
NWC of 38th Street and Genevieve Avenue
City of San Bernardino, California
IFE Project No. S168-193

At your request, this firm has prepared a geologic hazards report for the proposed new San Bernardino County Fire Station 227, as referenced above. The purpose of this study was to evaluate the existing geologic conditions of the property and any corresponding potential geologic and/or seismic hazards, with respect to the proposed development from a geologic standpoint. This report has been prepared utilizing the suggested "Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings" (CGS Note 48, 2022).

The scope of services provided for this evaluation included the following:

- **Review of available published and unpublished geologic/seismic data in our files pertinent to the site, including the provided site-specific boring logs.**
- **Performing a seismic surface-wave survey by a licensed State of California Professional Geophysicist that included one traverse for shear-wave velocity analysis purposes.**
- **Evaluation of the local and regional tectonic setting and historical seismic activity, including performing a site-specific CBC ground motion analysis.**
- **Preparation of this report presenting our findings, conclusions, and recommendations from a geologic standpoint.**

Accompanying Maps and Appendices

- Plate 1 - Regional Geologic Map
- Plate 2 - Google™ Earth Imagery Map
- Plate 3 - Site Plan
- Appendix A - Shear-Wave Survey
- Appendix B - Site-Specific Ground Motion Analysis
- Appendix C - References

PROJECT SUMMARY

We understand that this report will be appended to your current geotechnical investigation, therefore, some descriptive sections such as site description, proposed development, etc., have been purposely omitted as they have been described in detail in your referenced report. No grading plans were available for this evaluation, and no field or subsurface exploration was performed by this firm. Only a review of available geologic and geotechnical data in our files was undertaken, including observation of the exploratory borings that were drilled by Inland Foundation engineering, Inc. (IFE) on July 11, 2024, including performing a seismic shear-wave survey.

GEOLOGIC SETTING

The subject site lies within a natural geomorphic province in California known as the Peninsular Ranges. This province is characterized by northwest-trending valleys and mountains that are, in part, due to the tectonic framework of this area, which is also dominated by a northwest-trending structure. Locally, the study area is included within a sub-structural unit of the Peninsular Ranges known as the San Bernardino Valley Block. This block is essentially a depressed region bounded by faults to the northeast (San Andreas), the southwest (San Jacinto), and the south (Banning).

The San Bernardino Valley is formed by a series of coalescing alluvial fans, of which the combined fan of the Santa Ana River and Mill Creek, originating from to the northeast, is the largest and most distinct. This and other alluvial fans (i.e., Lytle and Cajon Creeks, Devil Canyon, East Twin and City Creeks) emanate the mountains, then coalesce to form part of a broad alluvial plain, which then forms the San Bernardino Valley.

The subject area investigated for this report is included within the flood/alluvial plain limits of the San Bernardino Valley, situated near the eastern flank of Little Mountain, which is a low-lying bedrock hill that locally protrudes from the San Bernardino Valley. Geologic mapping of the area by Miller et al. (2001), as illustrated on Plate 1, indicates that the project development area is locally underlain by both slightly- to moderately consolidated early Holocene and late Pleistocene alluvial fan deposits (map symbol Qyf₁), generally described as sand and pebble-boulder gravel, along with late Holocene age very young wash deposits (map symbol Qw), consisting of unconsolidated to locally cemented sand, gravel, and boulder deposits. Relatively older and more consolidated alluvial deposits are presumed to underlie the subject site at depth.

The exploratory boring logs prepared by IFE (2024) indicate that the subject site is underlain predominantly by interbedded fine- to medium-grained silty sand, fine- to coarse-grained sand with silt, fine- to coarse-grained sand, and gravel with fine- to coarse-grained sand, along with gravel and cobbles throughout. These alluvial deposits were noted to be in a generally loose to very dense condition, to a depth of at least 50½ feet locally.

FAULTING

There are at least forty-three major late Quaternary active/potentially active faults that are located within a 100-kilometer (62-mile) radius of the subject site (Blake, 1989-2000). Of these, there are no known active faults that traverse the site based on available published literature, nor was there any surficial geomorphic evidence that was suggestive of faulting. Additionally, the subject site is not located within a State of California "Alquist-Priolo Earthquake Fault Zone" for surface-fault rupture hazard (California Division of Mines and Geology, 1974).

The nearest known "active" fault that is zoned by the California Geological Survey is the San Andreas Fault (San Bernardino North Segment), located approximately $1.1 \pm$ miles to the northeast (C.D.M.G., 1974), as shown on the Regional Geologic Map, Plate 1, for reference. This fault segment is a right-lateral, strike-slip fault, being approximately 103-kilometers in length, with an associated maximum moment magnitude (M_w) of 7.4 and a slip-rate of 24 ± 6 mm/year (C.D.M.G., 1996, Cao, et al., 2003, and Petersen et al., 2008).

However, for seismic design purposes, we are considering that a cascading effect of rupture will occur along the entire length of the southern San Andreas Fault Zone (which includes ten segments, collectively) rather than just the San Bernardino North segment. Based on the recently published rupture-model data (Petersen et al., 2008), the total rupture area of these combined faults is 6,849.7 square kilometers and has an associated Maximum Moment Magnitude (M_w) of 8.1.

GROUND MOTION ANALYSIS

According to California Geological Survey Note 48 (CGS, 2022), a site-specific ground motion analysis is required for the subject site (CBC, 2022, Section 1613A and also as required by ASCE 7-16, Chapter 21). The results of this analysis are presented within Appendix B for documentation purposes. Additionally, a seismic shear-wave survey was conducted for this study by our firm as presented within Appendix A of this report for purposes of determining the soil Site Classification and V_{s30} input values for the ground motion analysis. This survey was performed within the limits of the proposed construction.

Geographically, the subject construction area is centrally located at Latitude 34.1601 and Longitude -117.2866 and (World Geodetic System of 1984 coordinates). The mapped spectral acceleration parameters, coefficients, and other related seismic parameters, were evaluated using the California's Office of Statewide Health Planning and Development Seismic Design Maps (OSHPD, 2024) and the California Building Code criteria (CBC, 2022), with the site-specific ground motion analysis being performed following Section 21 of the ASCE 7-16 Standard (2017). The results of this site-specific analysis have been summarized and are tabulated below:

TABLE 1 – SUMMARY OF SEISMIC DESIGN PARAMETERS

Factor or Coefficient	Value
S_s	2.506g
S₁	1.002g
F_a	1.2
F_v	1.7
S_{DS}	1.670g
S_{D1}	1.620g
S_{MS}	2.506g
S_{M1}	2.429g
T_L	8 Seconds
MCEG PGA	0.95g
Shear-Wave Velocity (V₁₀₀)	1,075.1 ft/sec
Site Classification	D
Risk Category	IV

HISTORIC SEISMICITY

A computerized search, based on Southern California historical earthquake catalogs, has been performed using the computer program EQSEARCH (Blake, 1989-2021) and the ANSS Comprehensive Earthquake Catalog (U.S.G.S., 2024a). The following table and discussion summarizes the historic seismic events (greater than or equal to M4.0) that have been estimated and/or recorded during the time period of 1800 to July 2024, within a 100-kilometer radius of the site.

TABLE 2 - HISTORIC SEISMIC EVENTS; 1800-2024 (100-kilometer radius)

<u>Richter Magnitude (M)</u>	<u>No. of Events</u>
4.0 - 4.9	628
5.0 - 5.9	73
6.0 - 6.9	15
7.0 - 7.9	1
8.0+	0

It should be noted that pre-instrumental seismic events (generally before 1932) have been estimated from isoseismal maps (Toppozada, et al., 1981 and 1982). These data have been compiled generally based on the reported intensities throughout the region, thus focusing in on the most likely epicentral location. Instrumentation beyond 1932 has greatly increased the accuracy of locating earthquake epicenters. A summary of the historic earthquake data is as follows:

- ❑ The closest recorded notable earthquake epicenter (magnitude 4.0 or greater) is a M4.2 event (June 28, 1997), which occurred approximately three miles to the west-northwest.
- ❑ The nearest estimated significant historic earthquake epicenter (pre-1932) was approximately 4± miles southwest of the site (July 15, 1905, M5.3).
- ❑ The nearest recorded significant historic earthquake epicenter was a M5.6 event of October 16, 1999, located approximately 15 miles northeast of the site.
- ❑ The largest estimated historical earthquake epicenter (pre-1932) within a 62-mile radius of the site is a M6.9 event of December 8, 1812 (25± miles northwest).
- ❑ The largest recorded historical earthquake was the M7.6 Landers's event, located approximately 49 miles to the east (June 28, 1992).
- ❑ The largest estimated ground acceleration estimated to have been experienced at the site was at least 0.215g which resulted from the M5.3 event of July 15, 1905, located approximately 4± miles to the southwest (Blake, 1989-2000b) based on the attenuation relationship of Boore et al. (1997).

An Earthquake Epicenter Map which includes magnitudes 4.0 and greater for a 100-kilometer (62-mile) radius (blue circle) from the site (central blue dot), has been included below as Figure 1. This map was prepared using the ANSS Comprehensive Earthquake Catalog (U.S.G.S, 2024a) of instrumentally recorded events from the period of 1932 to July 2024.

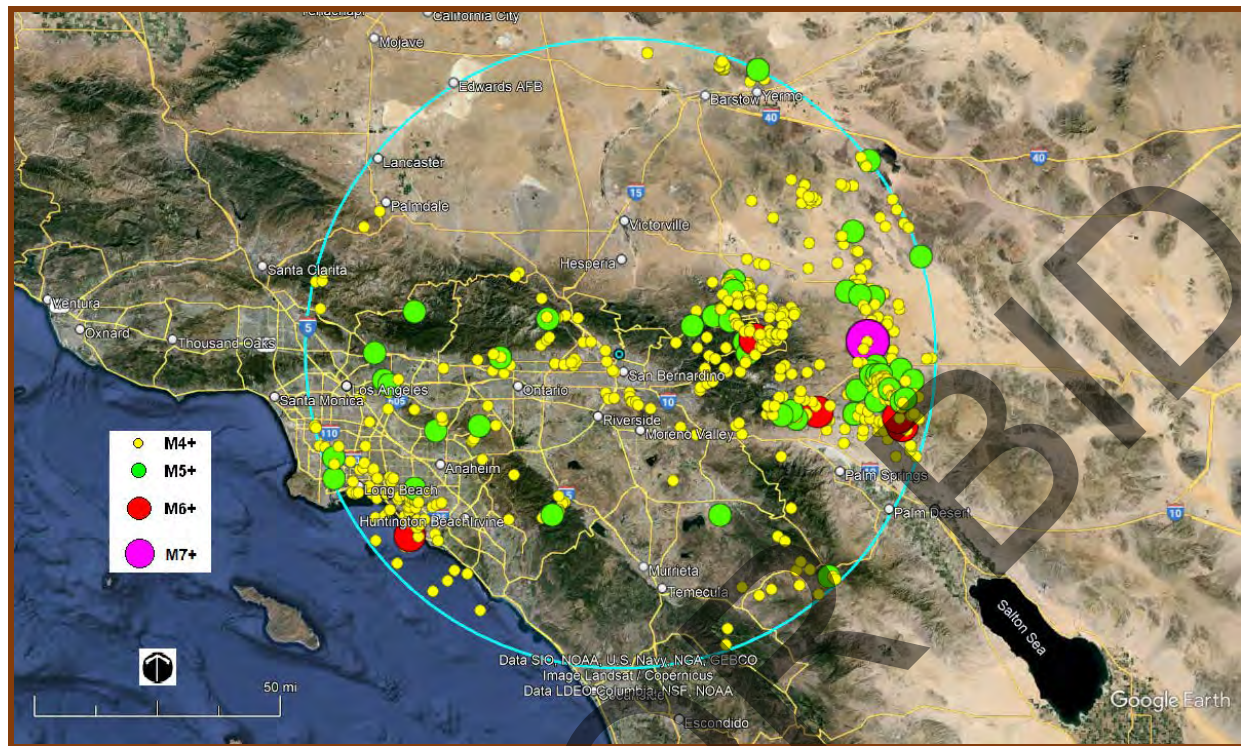


FIGURE 1- Earthquake Epicenter Map showing events of M4.0+ within a 100-kilometer radius.

GROUNDWATER

The subject site is located within the Bunker Hill Basin, which is a subunit of the greater Upper Santa Ana Valley Groundwater Basin in Southern California. This basin is bordered on the west by the San Jacinto Fault, the northeast by the San Bernardino Mountains, the south by the Badlands, and east by Crafton Hills. The area of the basin is approximately 110 square miles. The water-bearing material in the basin consists of alluvial deposits of sand, gravel, and boulders interspersed with lenticular deposits of silt and clay. In the Bunker Hill Basin, most of the recharge to groundwater is supplied by runoff from the San Bernardino Mountains, and smaller amounts by deep penetration of rainfall and artificial recharge. Within the Bunker Hill Basin, groundwater generally flows similar to that of surface draining. Locally, groundwater flows toward the southwest (Duell and Schroeder, 1989).

Based on groundwater data provided by the California Department of Water Resources (2024b), the closest measured well was located $1,900 \pm$ feet southeast of the site (State Well No. 01N04W22J001S), which indicates that groundwater had ranged from a depth of 124 to $154 \pm$ feet between the time period of 1940 to 1944. Groundwater data prepared by Matti and Carson (1991) indicates that high groundwater was estimated to be around $150 \pm$ feet in depth based on contour data. During the recent subsurface investigation performed by IFE (2024), groundwater was not encountered within any of the exploratory borings excavated at the site to a depth of at least $50\frac{1}{2}$ feet.

SECONDARY SEISMIC HAZARDS

Secondary permanent or transient seismic hazards that are generally associated with severe ground shaking during an earthquake include ground rupture, liquefaction, seiches or tsunamis, flooding (water storage facility failure), ground lurching/lateral spreading, landsliding, rockfalls, and seismically-induced settlement. These hazards are discussed below.

Ground Rupture- Ground rupture is generally considered most likely to occur along pre-existing faults. Since no known active faults are believed to traverse the subject site, the probability of ground rupture is considered very low to nil.

Ground Lurching/Lateral Spreading- Ground lurching is the horizontal movement of soil, sediments, or fill located on relatively steep embankments or scarps as a result of seismic activity, forming irregular ground surface cracks. The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground. Due to the flat-lying nature of the site, distance from embankments, the potential for ground lurching and/or lateral spreading is nil.

Seismically-Induced Settlement- Seismically-induced settlement generally occurs within areas of loose granular soils. The proposed construction area is locally underlain by interbedded fine- to medium-grained silty sand, fine- to coarse-grained sand with silt, fine- to coarse-grained sand, and gravel with fine- to coarse-grained sand, with gravel and cobbles throughout. Locally, portions of the upper 8± feet of the surface were noted to be in a loose condition, directly underlain by medium dense to very dense sediments, to a depth of at least 50½ feet. Therefore, there appears to be at least a low potential for seismically-induced settlement to occur.

Landsliding- Due to the relatively low-lying relief of the site, landsliding of the site due to seismic shaking is considered nil. According to the City of San Bernardino Slope Stability and Major Landslides Map (2005, Figure S-7), the site is not shown to be within the limits of generalized landslide susceptibility.

Liquefaction- In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soils from repeated disturbances of saturated cohesionless soil that can result in the settlement of buildings, ground failures, or other such related hazards. The main factors generally contributing to this phenomenon are: 1) cohesionless, granular soils having relatively low densities (usually of Holocene age); 2) shallow groundwater (generally less than 40 feet); and 3) moderate-high seismic ground shaking. According to the City of San Bernardino Liquefaction Susceptibility Map (2005, Figure S-5), the subject site is not shown to be located within the limits of a liquefaction zone. Due to the greater than 50-foot depth to groundwater, dense nature of the alluvial deposits at depth, there does not appear to be a potential for liquefaction to occur.

Flooding (Water Storage Facility Failure)- Based on the data prepared by the California Department of Water Resources (2024a), the subject site is shown to be located within the limits of flood inundation in the event of catastrophic failure of the Little Mountain Dam, which is located approximately 2,700± feet to the northwest, as generally indicated on Figure 2 below (site outlined in red). Therefore, the potential for flooding due to water storage facility failure is considered possible. There are no other water-storage facilities that are topographically higher than that of the subject site, which could cause flooding due to catastrophic failure.

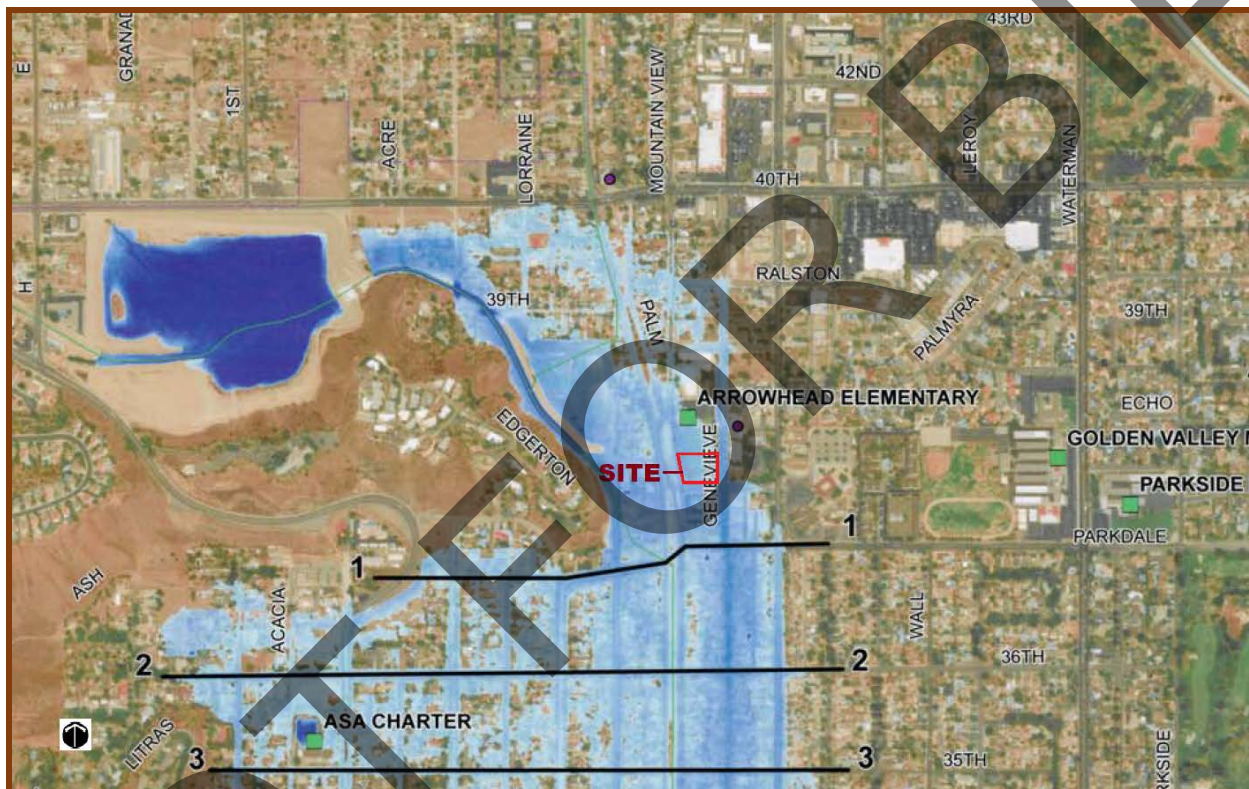


FIGURE 2- Dam Inundation Map (San Bernardino County, 2018); flooding shown as blue shading.

Seiches/Tsunamis-

Based on the far distance of large, open bodies of water and the elevation of the site with respect to sea level, the possibility of seiches/tsunamis is considered nil. Additionally, mapping by the California Geological Survey (2014) does not indicate the site to be located within a tsunami inundation zone.

Rockfalls-

The subject site lies upon a relatively flat-lying alluvial plain. Since no large rock outcrops are present at or adjacent to the site, the possibility of rockfalls during seismic shaking is nil.

FLOODING

According to the Federal Emergency Management Agency (FEMA), the subject site is not located within the boundaries of a 100-year flood (Community Panel No. 06071C 7945H, September 26, 2008). The site is shown to be located within “Other Flood Areas - Zone X,” which is defined as “Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.” A portion of the FEMA Flood Zone Map is shown below in Figure 2 for reference.

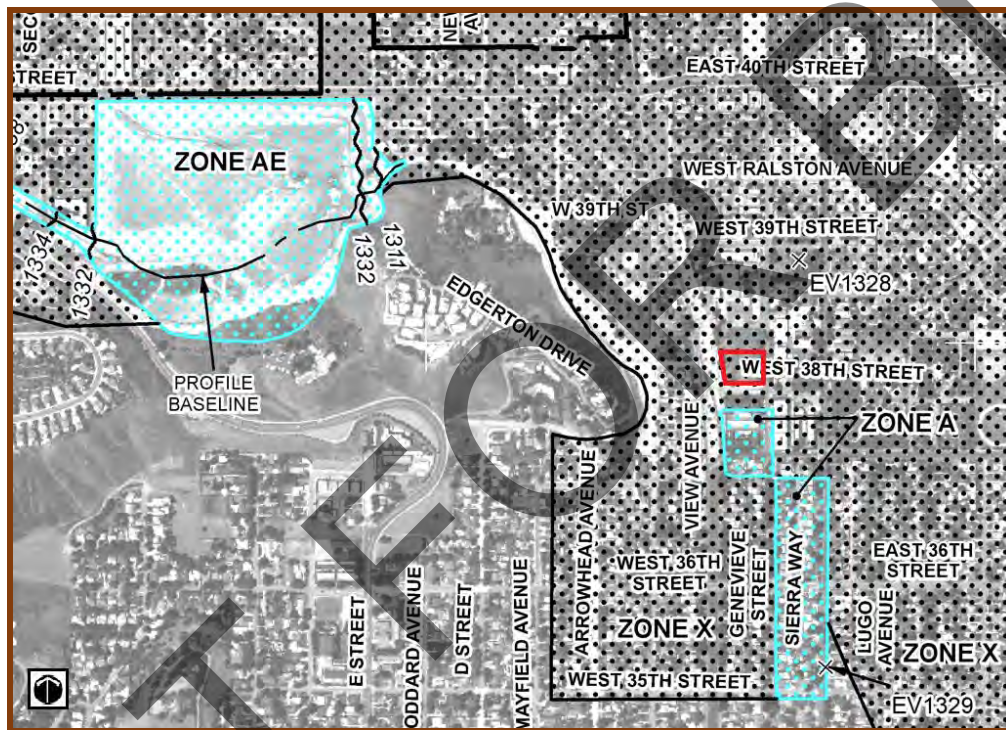


FIGURE 2- FEMA Flood Zone Map; Site boundary approximated by red outline.

GROUND SUBSIDENCE

Ground subsidence can be caused by natural geologic processes or by human activity such as groundwater and/or oil withdrawal and subsurface mining. Historic ground subsidence within the City of San Bernardino was generally located within the thick, poorly consolidated alluvial and marsh deposits of an old artesian area north of Loma Linda. Beginning in 1972, the San Bernardino Municipal Water District has maintained groundwater levels from recharge to percolation basins that, in turn, filter back into the alluvial deposits. Since the groundwater recharge program began, problems with ground subsidence in the valley have not been identified. According to the City of San Bernardino Potential Subsidence Areas Map (2005, Figure S-6), the subject site is not shown to be located within the limits of “Areas of Potential Ground Subsidence”.

OTHER GEOLOGIC HAZARDS

There are other potential geologic hazards not necessarily associated with seismic activity that occur statewide. These hazards include; natural hazardous materials (such as methane gas, hydrogen-sulfide gas, and tar seeps); Radon-222 gas (EPA, 1993); naturally occurring asbestos; volcanic hazards (Martin, 1982); and regional subsidence. Of these hazards, there are none that appear to impact the site.

CONCLUSIONS AND RECOMMENDATIONS

General:

Based on our review of available pertinent published and unpublished geologic/seismic literature, construction of the proposed new fire station facility appears to be feasible from a geologic standpoint, providing our recommendations are considered during planning and construction.

Conclusions:

1. Based on available published geologic data, the subject site is underlain by both slightly- to moderately consolidated early Holocene and late Pleistocene alluvial fan deposits, generally described as sand and pebble-boulder gravel, along with late Holocene age very young wash deposits, consisting of unconsolidated to locally cemented sand, gravel, and boulder deposits. Site-specific exploration performed by IFE indicates the site to be underlain by interbedded fine- to medium-grained silty sand, fine- to coarse-grained sand with silt, fine- to coarse-grained sand, and gravel with fine- to coarse-grained sand, with gravel and cobbles throughout. Locally, portions of the upper 8± feet of the surface were noted to be in a loose condition, directly underlain by medium dense to very dense sediments, to a depth of at least 50½ feet.
2. Groundwater was not encountered within the exploratory excavations performed by IFE to a depth of at least 50½ feet. Nearby historic and current groundwater data indicate that groundwater may have been as high as 125± feet in depth, locally. No shallow groundwater conditions are anticipated to be encountered during construction.
3. Based on our literature research, there are no active faults that are known to traverse the subject site. The nearest zoned active fault is associated with the active San Andreas Fault (North Branch) located approximately 1.1± miles to the northeast.
4. The primary geologic hazard that exists at the site is that of ground shaking, which accounts for nearly all earthquake losses. Moderate to severe ground shaking could be anticipated during the life of the proposed development.

5. Due to the nature of the surficial underlying unconsolidated sediments, there may be a potential for secondary seismic settlement to occur. Additionally, the site lies within the inundation limits in the event of catastrophic failure of the Little Mountain Dam, located approximately 2,700± feet to the northwest. No other permanent and/or transient secondary seismic hazards are expected to occur within the proposed construction area.

Recommendations:

1. The potential for seismically-induced settlement should be properly evaluated by the project Geotechnical Engineer. Appropriate site-specific mitigation measures, should be implemented as recommended, if warranted.
2. The potential for flooding due to catastrophic failure of Little Mountain Dam should be properly evaluated by the project Civil Engineer or other appropriate design professional. Appropriate site-specific mitigation measures, should be implemented as recommended, if warranted.
3. It is recommended that all structures be designed to at least meet the current California Building Code provisions in the latest 2022 CBC edition and the 2016 ASCE Standard 7-16, where applicable. However, it should be noted that the building code is intended as a minimum construction design and is often the maximum level to which structures are designed. Structures that are built to minimum code are designed to at least remain operational after an earthquake. It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the proposed facilities. When considering that a cascading rupture event could occur along the entire length of the San Andreas Fault Zone (which includes all segments), the resulting maximum moment magnitude earthquake is estimated to be Mw8.1, which should be used for seismic design purposes.

CLOSURE

Our conclusions and recommendations are based on a review of available existing published geologic/seismic data and the provided site-specific subsurface exploratory boring logs. No subsurface exploration was performed by this firm for this evaluation. We make no warranty, either express or implied. Should conditions be encountered at a later date or more information becomes available that appear to be different than those indicated in this report, we reserve the right to reevaluate our conclusions and recommendations and provide appropriate mitigation measures, if warranted. It is assumed that all the conclusions and recommendations outlined in this report are understood and followed.

If any portion of this report is not understood, it is the responsibility of the owner, contractor, engineer, and/or governmental agency, etc., to contact this office for further clarification.

Respectfully submitted,
TERRA GEOSCIENCES

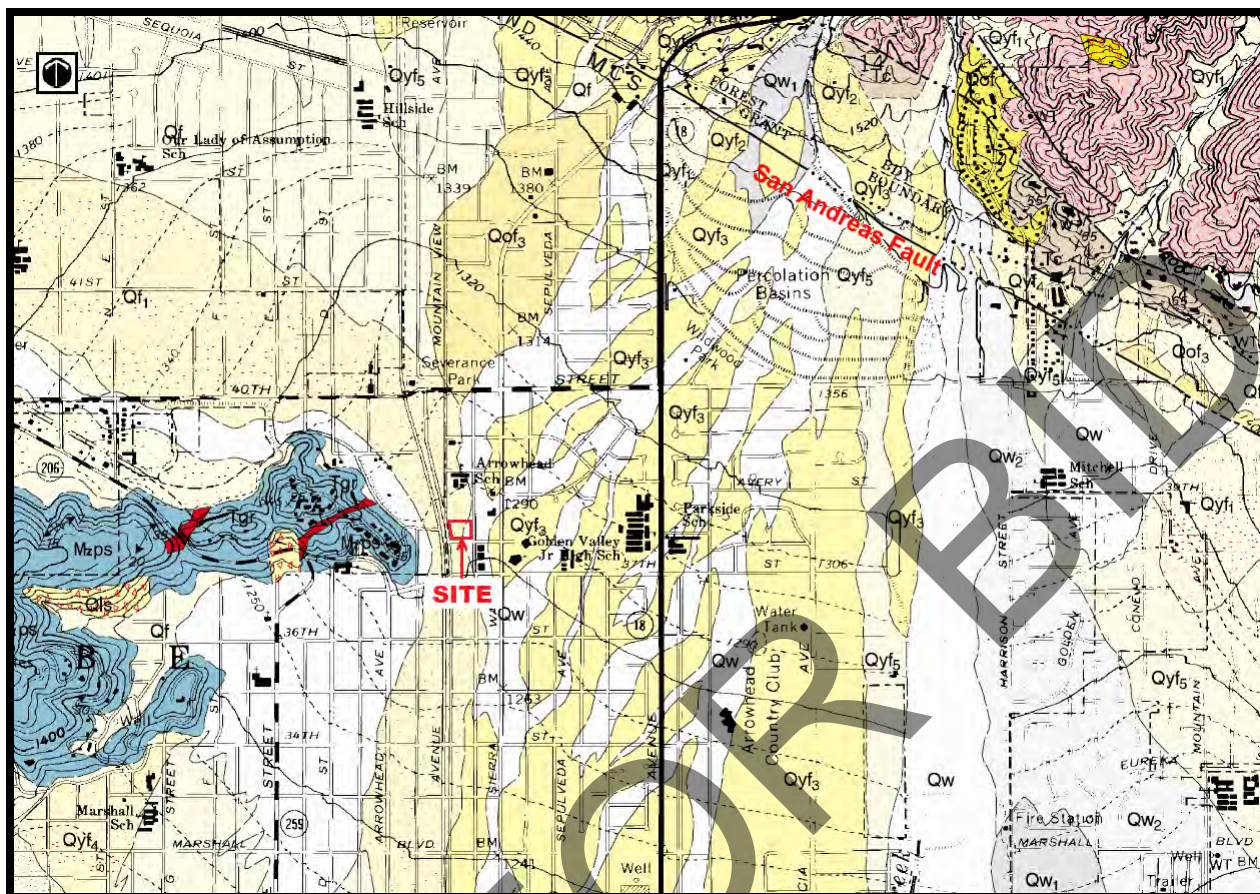


Donn C. Schwartzkopf
Principal Geologist / Geophysicist
CEG 1459 / PGP 1002



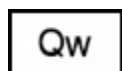
NOT FOR

REGIONAL GEOLOGIC MAP



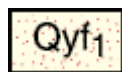
BASE MAP: Miller et al. (2001), U.S.G.S., Open File Report 01-131, Scale 1: 24,000, Site outlined in red.

PARTIAL LEGEND



YOUNG WASH DEPOSITS

Unconsolidated to locally cemented sand, gravel and boulders (late Holocene).



YOUNG FAN DEPOSITS

Slightly- to moderately-consolidated sand and pebble-boulder gravel (early Holocene and late Pleistocene).



PELONA SCHIST

Muscovite-chlorite-albite-quartz schist, fine-grained (Mesozoic).



GEOLOGIC CONTACT

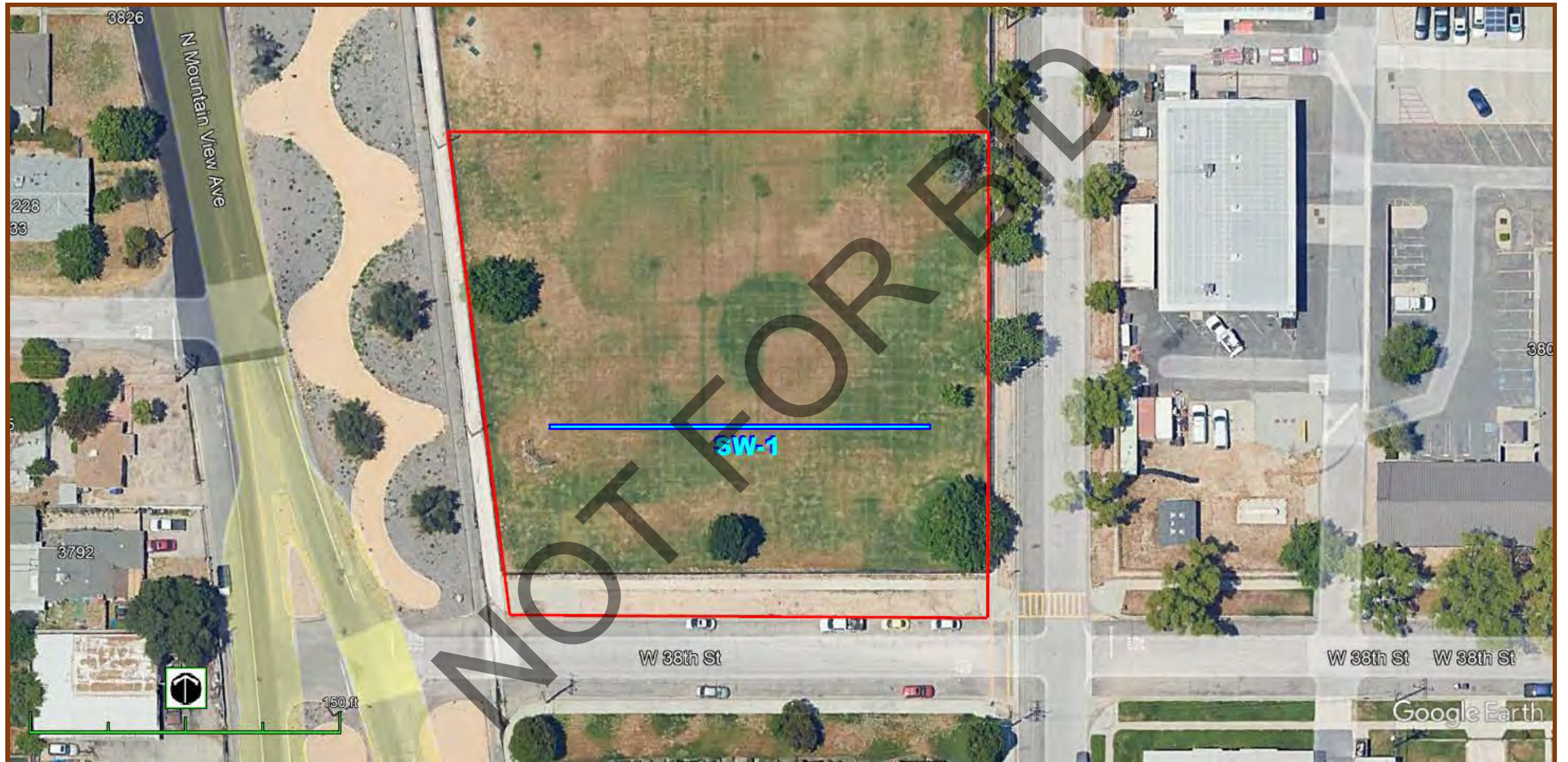
Solid where located within 15± meters; dashed where located within 30± meters.



FAULT

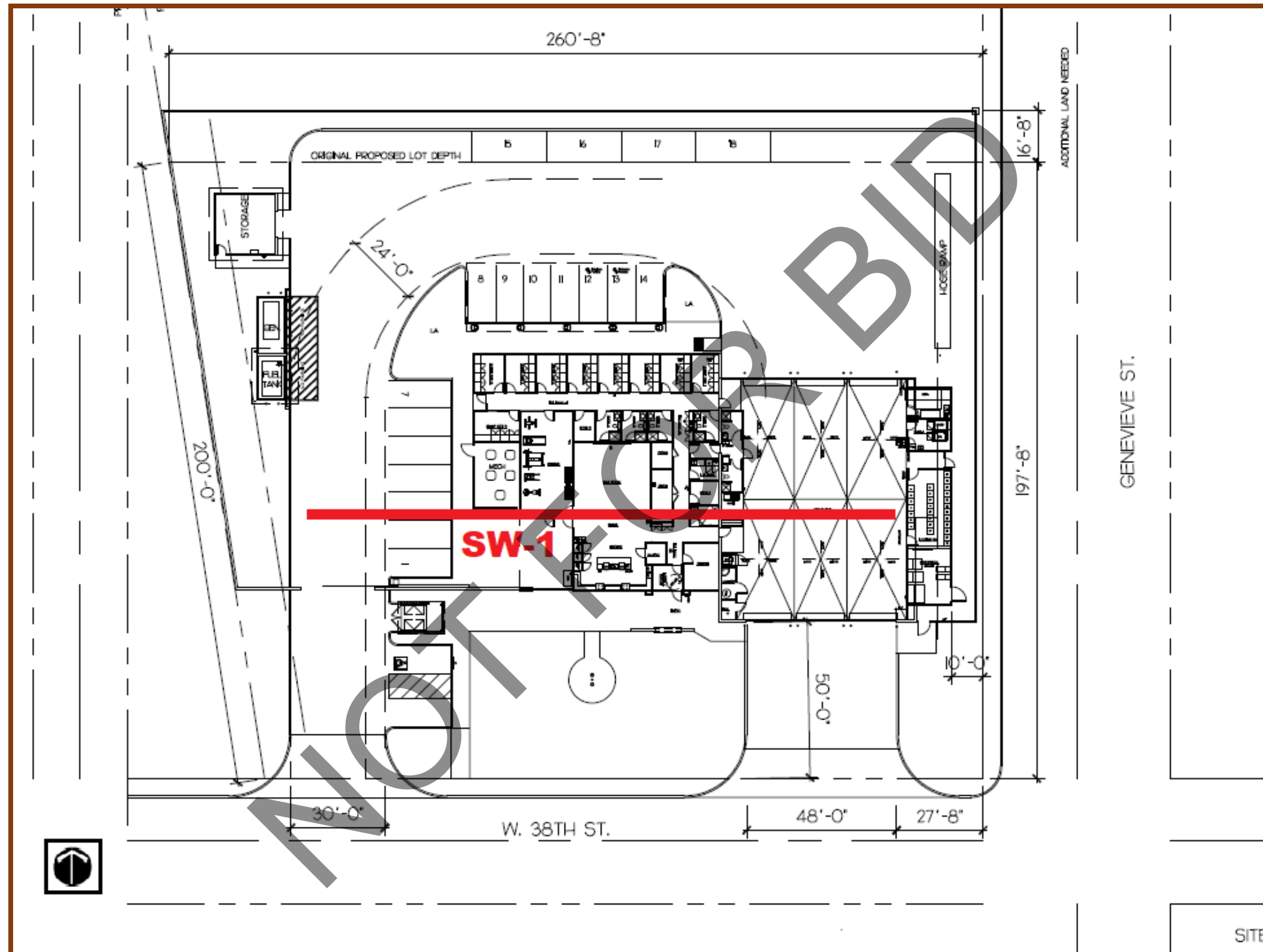
Solid where located within 15± meters; dashed where located within 30± meters; dotted where concealed.

GOOGLE™ EARTH IMAGERY MAP



Base Map: Captured Google™ Earth (2024); Seismic shear-wave traverse **SW-1** shown as blue line, approximate site boundary outlined in red.

SITE PLAN



BASE MAP: Provided "FS 227 Conceptual Site Plan" (Sheet A0.1, dated 6/12/24); prepared by STK Architecture, Inc., Temecula, California.

APPENDIX A

SHEAR-WAVE SURVEY

NOT FOR BIDD



SHEAR-WAVE SURVEY

Methodology

The fundamental premise of this survey uses the fact that the Earth is always in motion at various seismic frequencies. These relatively constant vibrations of the Earth's surface are called microtremors, which are very small with respect to amplitude and are generally referred to as background "noise" that contain abundant surface waves. These microtremors are caused by both human activity (i.e., cultural noise, traffic, factories, etc.) and natural phenomenon (i.e., wind, wave motion, rain, atmospheric pressure, etc.) which have now become regarded as useful signal information. Although these signals are generally very weak, the recording, amplification, and processing of these surface waves has greatly improved by the use of technologically improved seismic recording instrumentation and recently developed computer software. For this application, we are mainly concerned with the Rayleigh wave portion of the seismic signals, which is also referred to as "ground roll" since the Rayleigh wave is the dominant component of ground roll.

For the purposes of this study, there are two ways that the surface waves were recorded, one being "active" and the other being "passive." Active means that seismic energy is intentionally generated at a specific location relative to the survey spread and recording begins when the source energy is imparted into the ground (i.e., MASW survey technique). Passive surveying, also called "microtremor surveying," is where the seismograph records ambient background vibrations (i.e., MAM survey technique), with the ideal vibration sources being at a constant level. Longer wavelength surface waves (longer-period and lower-frequency) travel deeper and thus contain more information about deeper velocity structure and are generally obtained with passive survey information. Shorter wavelength (shorter-period and higher-frequency) surface waves travel shallower and thus contain more information about shallower velocity structure and are generally collected with the use of active sources.

For the most part, higher frequency active source surface waves will resolve the shallower velocity structure and lower frequency passive source surface waves will better resolve the deeper velocity structure. Therefore, the combination of both of these surveying techniques provides a more accurate depiction of the subsurface velocity structure.

The assemblage of the data that is gathered from these surface wave surveys results in development of a dispersion curve. Dispersion, or the change in phase velocity of the seismic waves with frequency, is the fundamental property utilized in the analysis of surface wave methods. The fundamental assumption of these survey methods is that the signal wavefront is planar, stable, and isotropic (coming from all directions) making it independent of source locations and for analytical purposes uses the spatial autocorrelation method (SPAC). The SPAC method is based on theories that are able to detect "signals" from background "noise" (Okada, 2003). The shear wave velocity (V_s) can then be calculated by mathematical inversion of the dispersive phase velocity of the surface waves which can be significant in the presence of velocity layering, which is common in the near-surface environment.

Field Procedures

One shear-wave survey traverse (SW-1) was performed within proposed construction area, as approximated on Plates 1 and 2. For data collection, the field survey employed a twenty-four channel Geometrics StrataVisor™ NZXP model signal-enhancement refraction seismograph. This survey employed both active source (MASW) and passive (MAM) methods to ensure that both quality shallow and deeper shear-wave velocity information was recorded (Park et al., 2005).

Both the MASW and MAM survey lines used the same linear geometry array that consisted of a 184-foot-long spread using a series of twenty-four 4.5-Hz geophones that were spaced at regular eight-foot intervals. For the active source MASW survey, the ground vibrations were recorded using a one second record length at a sampling rate of 0.5-milliseconds. Two separate seismic records were obtained using a 30-foot shot offset at both ends of the line utilizing a 16-pound sledge-hammer as the energy source to produce the seismic waves. Numerous seismic impacts were used at each shot location to improve the signal-to-noise ratio.

The MAM survey did not require the introduction of any artificial seismic sources with only background ambient noise (i.e., air and vehicle traffic, etc.) being necessary. These ambient ground vibrations were recorded using a thirty-two second record length at a two-millisecond sampling rate with 21 separate seismic records being obtained for quality control purposes. The frequency spectrum data that was displayed on the seismograph screen were used to assess the recorded seismic wave data for quality control purposes in the field. The acceptable records were digitally recorded on the in-board seismograph computer and subsequently transferred to a flash drive so that they could be subsequently transferred to our office computer for analysis.

Data Reduction

For analysis and presentation of the shear-wave profile and supportive illustration, this study used the **SeisImager/SW™** computer software program that was developed by Geometrics, Inc. (2021). Both the active (MASW) and passive (MAM) survey results were combined for this analysis (Park et al., 2005). The combined results maximize the resolution and overall depth range in order to obtain one high resolution V_s curve over the entire sampled depth range. These methods economically and efficiently estimate one-dimensional subsurface shear-wave velocities using data collected from standard primary-wave (P-wave) refraction surveys.

However, it should be noted that surface waves by their physical nature cannot resolve relatively abrupt or small-scale velocity anomalies and this model should be considered as an approximation. Processing of the data then proceeded by calculating the dispersion curve from the input data from both the active and passive data records, which were subsequently combined creating an initial shear-wave (V_s) model based on the observed data. This initial model was then inverted in order to converge on the best fit of the initial model and the observed data, creating the final V_s curve as presented within this appendix.

Summary of Data Analysis

Data acquisition went very smoothly and the quality was considered to be good. Analysis revealed that the average shear-wave velocity (“weighted average”) in the upper 100 feet of the subject survey area is **1,075.1** feet per second (327.7 meters/second) as shown on the shear-wave model for Seismic Line SW-1, as presented within this appendix. This average velocity classifies the underlying soils to that of Site Class “**D**” (“Stiff Soil” profile), which has a velocity range from 600 to 1,200 ft/sec (ASCE, 2017; Table 20.3-1).

The “weighted average” velocity is computed from a formula that is used by the ASCE (2017; Section 20.4, Equation 20.4-1) to determine the average shear-wave velocity for the upper 100 feet of the subsurface (V_{100}).

$$V_s = 100 / [(d_1/v_1) + (d_2/v_2) + \dots + (d_n/v_n)]$$

Where $d_1, d_2, d_3, \dots, d_n$, are the thicknesses for layers 1, 2, 3, ..., n , up to 100 feet, and $v_1, v_2, v_3, \dots, v_n$, are the seismic velocities (feet/second) for layers 1, 2, 3, ..., n . The detailed shear-wave model displays these calculated layer boundaries/depths and associated velocities (feet/second) for the 200-foot profile where locally measured. The constrained data is represented by the dark-gray shading on the shear-wave model. The associated Dispersion Curves (for both the active and passive methods) which show the data quality and picks, along with the resultant combined dispersion curve model, are also included within this appendix, for reference purposes.

SURVEY LINE PHOTOGRAPHS



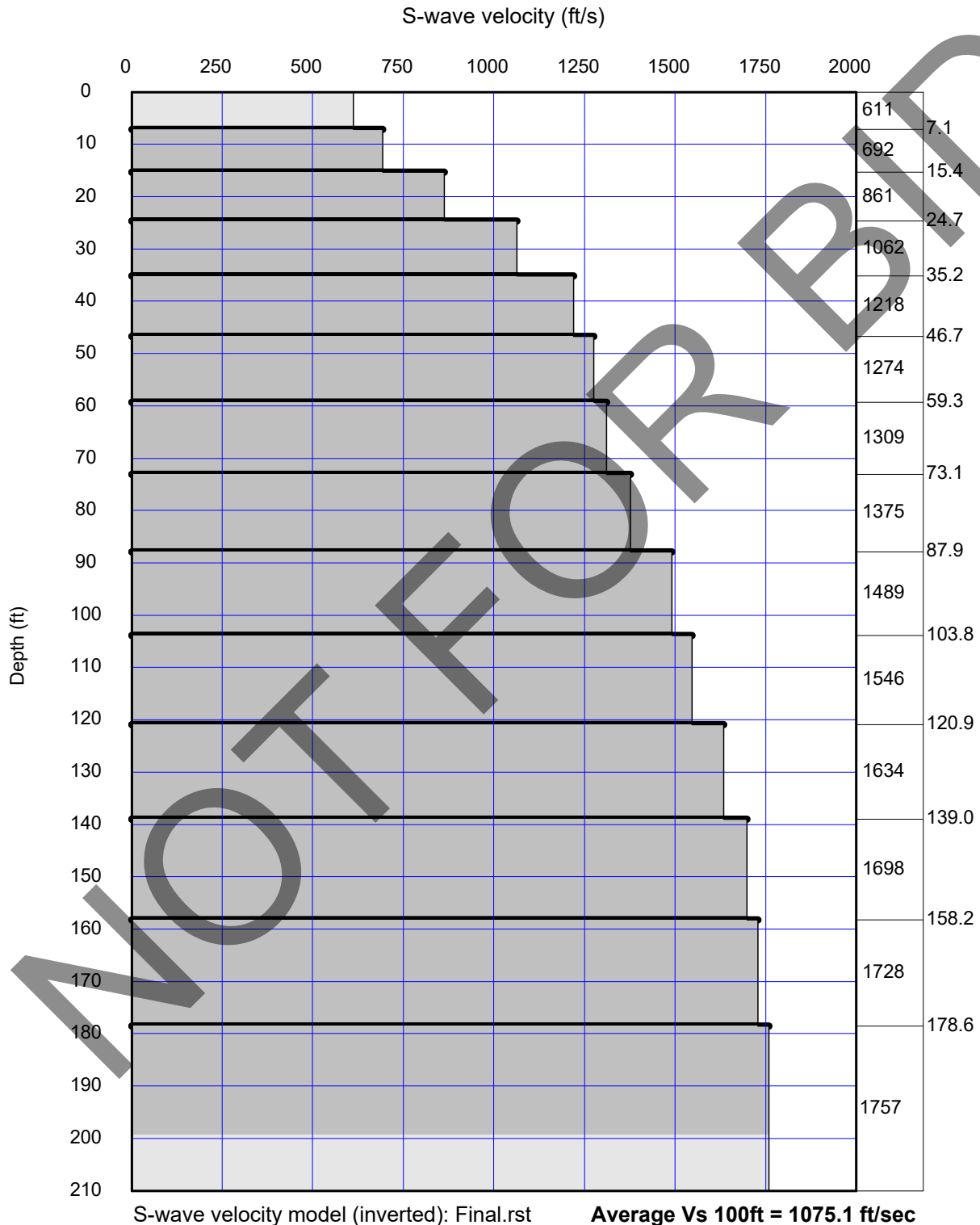
View looking west along Seismic Line SW-1.



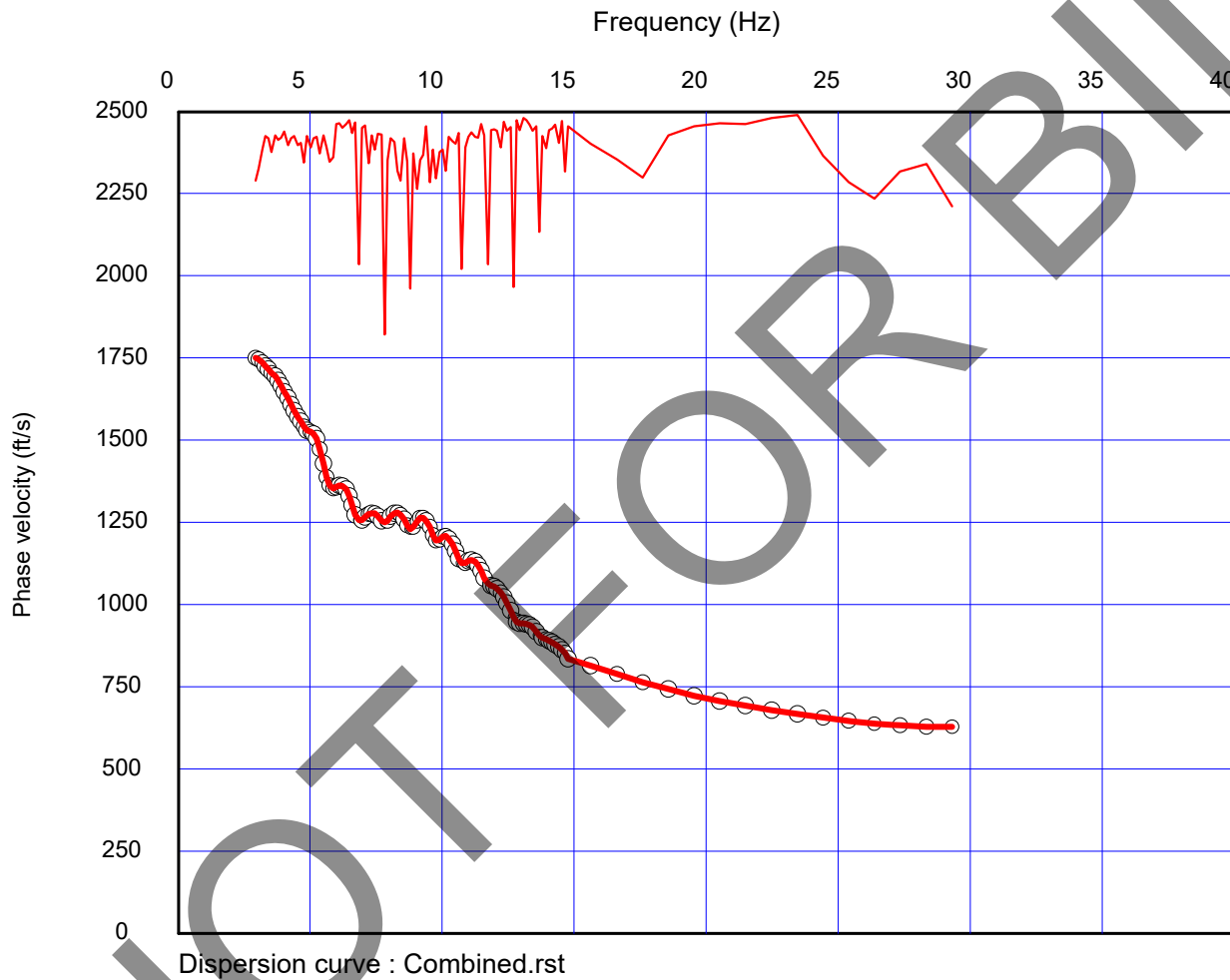
View looking east along Seismic Line SW-1.

SEISMIC LINE SW-1

SHEAR-WAVE MODEL

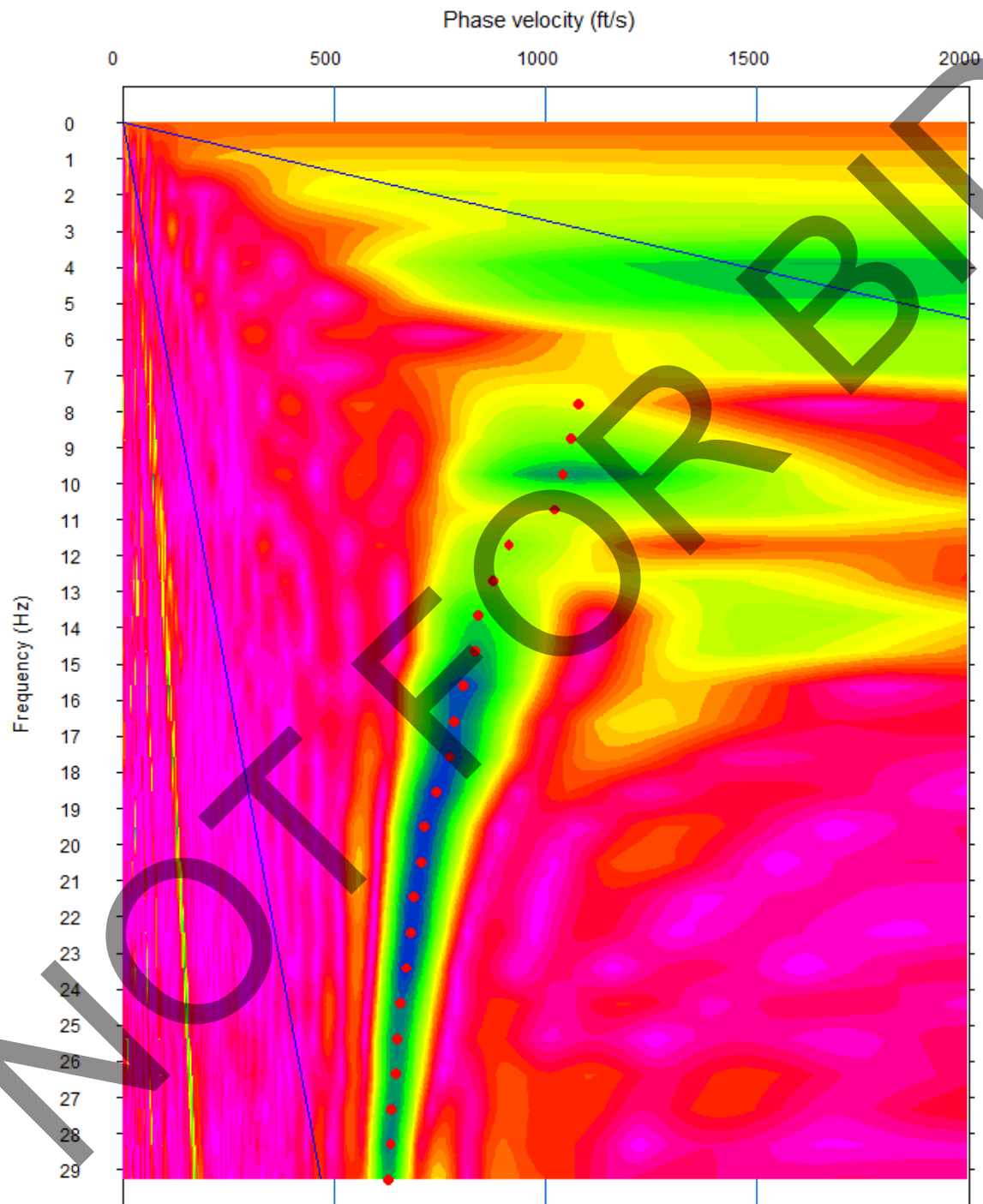


SEISMIC LINE SW-1



COMBINED DISPERSION CURVE

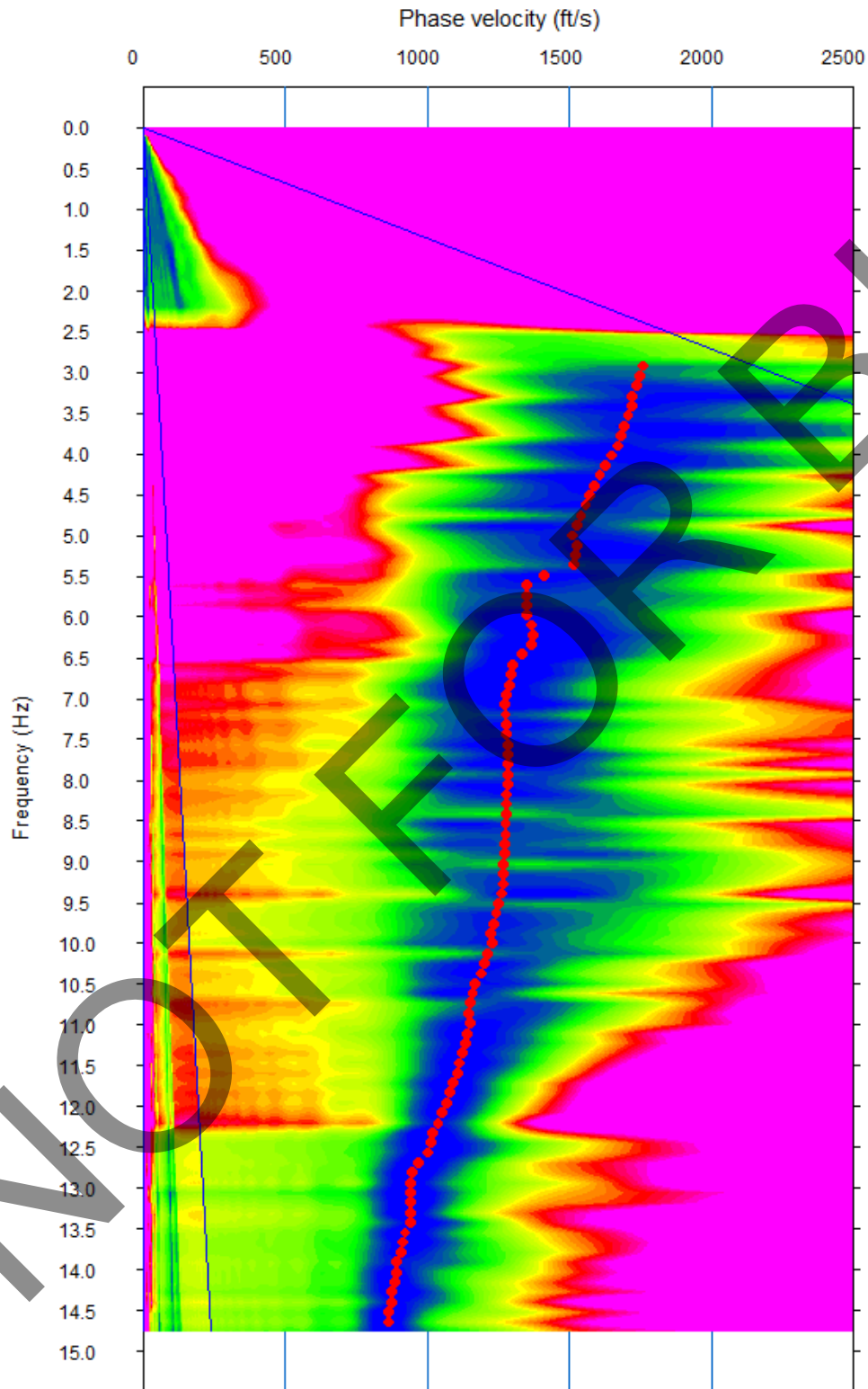
SEISMIC LINE SW-1



Dispersion Curve: Active.dat

ACTIVE DISPERSION CURVE

SEISMIC LINE SW-1



Dispersion Curve: Passive.dat

PASSIVE DISPERSION CURVE

APPENDIX B

SITE-SPECIFIC GROUND MOTION ANALYSIS

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SITE-SPECIFIC GROUND MOTION ANALYSIS

A detailed summary of the site-specific ground motion analysis, which follows Section 21 of the ASCE Standard 7-16 (2017) and the 2022 California Building Code is presented below, with the Seismic Design Parameters Summary included within this appendix following the summary text.

◆ Mapped Spectral Acceleration Parameters (CBC 1613A.2.1)-

Based on maps prepared by the U.S.G.S (Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for the 0.2 and 1-second Spectral Response Acceleration (5% of Critical Damping; Site Class B/C), a value of **2.506g** for the 0.2 second period (S_s) and **1.002g** for the 1.0 second period (S_1) was calculated (ASCE 7-16 Figures 22-1, 22-2 and CBC 1613A.2.1).

◆ Site Classification (CBC 1613A.2.2 & ASCE 7-16 Chapter 20)-

Based on the site-specific measured shear-wave value of 1,075.1 feet/second (327.7 meters/second), the soil profile type used should be Site Class “D.” This Class is defined as having the upper 100 feet (30 meters) of the subsurface being underlain by “stiff soil” with average shear-wave velocities of 600 to 1,200 feet/second (180 to 360 meters/second), as detailed within Appendix A.

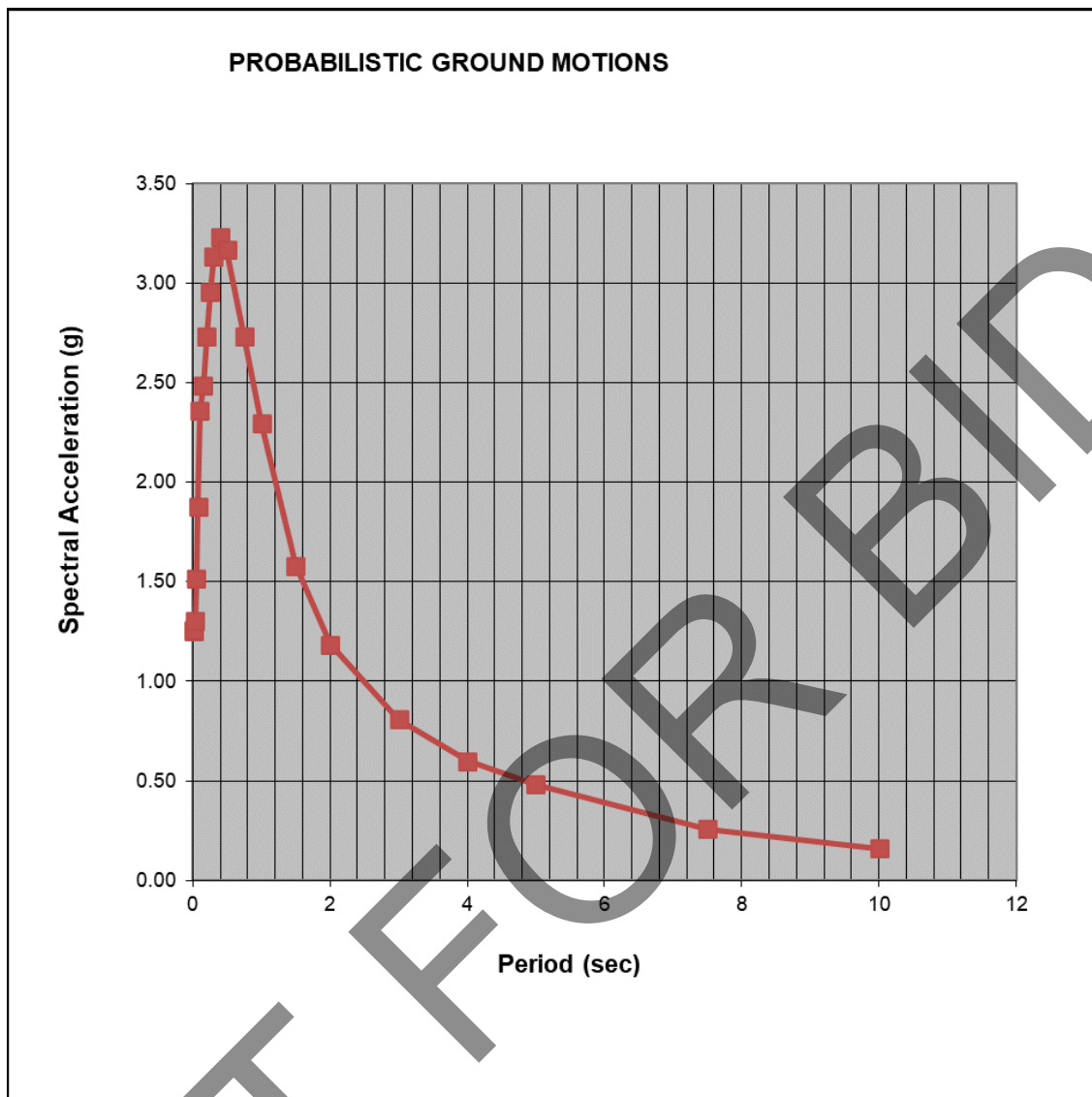
◆ Site Coefficients (CBC 1613A.2.3)-

Based on CBC Tables 1613A.2.3(1) and 1613A.2.3(2), the site coefficient $F_a = 1.2$ and $F_v = 1.7$, respectively.

◆ Probabilistic (MCE_R) Ground Motions (ASCE 7 Section 21.2.1)-

Per Section 21.2.1, the probabilistic MCE spectral accelerations shall be taken as the spectral response accelerations in the direction of maximum response represented by a five percent damped acceleration response spectrum that is expected to achieve a one percent probability of collapse within a 50-year period.

The probabilistic analysis included the use of the Open Seismic Hazard Analysis (OpenSHA). The selected Earthquake Rupture Forecast (ERF) was UCERF3 along with a Probability of Exceedance of 2% in 50 Years. The average of four Next Generation Attenuation West-2 Relations (2014 NGA) were utilized to produce a response spectrum. These included Chiou & Youngs (2014), Abrahamsom et al. (2014), Campbell & Bozorgnia (2014), Boore et al. (2014), and Campbell & Bozorgnia (2014). The Probabilistic Risk Targeted Response Spectrum was determined as the product of the ordinates of the probabilistic response spectrum and the applicable risk coefficient (C_R). These values were then modified to produce a spectrum based upon the maximum rotated components of ground motion. The resulting MCE_R Response Spectrum is indicated below:



◆ **Deterministic Spectral Response Analyses (ASCE 7 Section 21.2.2)-**

The deterministic MCE_R response acceleration at each period shall be calculated as an 84th-percentile 5 percent damped spectral response acceleration in the direction of maximum horizontal response computed at that period. The largest such acceleration calculated for the characteristic earthquakes on all known active faults within the region shall be used. Analyses were conducted using the average of four Next Generation Attenuation West-2 Relations (2014 NGA), including Chiou & Youngs (2014), Abrahamsom et al. (2014), Boore et al. (2014) and Campbell & Bozorgnia (2014).

Based on our review of the Fault Section Database within the Uniform California Earthquake Rupture Forecast (UCERF 3; Field et al., 2013), published geologic data, and based on the length (combined segments) and maximum magnitude of the San Andreas Fault Zone (southern section) located 1.8 kilometers to the northeast, a moment magnitude (M_w) used for this fault was 8.1.

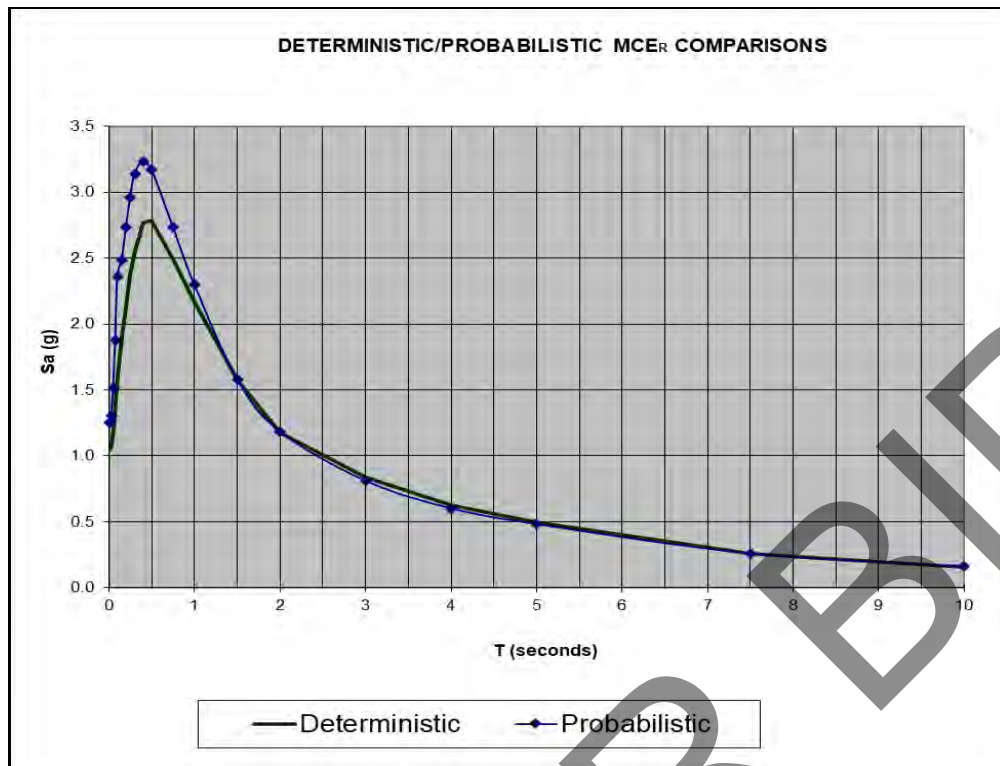
◆ **Site Specific MCE_R (ASCE 7 Section 21.2.3)-**

The site-specific MCE_R spectral response acceleration at any period, S_{aM} , shall be taken as the lesser of the spectral response accelerations from the probabilistic ground motions of Section 21.2.1 and the deterministic ground motions of Section 21.2.2. The deterministic ground motions were compared with the probabilistic ground motions that were determined in accordance with Section 21.2.1.

Comparison of Deterministic MCE_R Values with Probabilistic MCE_R Values - Section 21.2.3

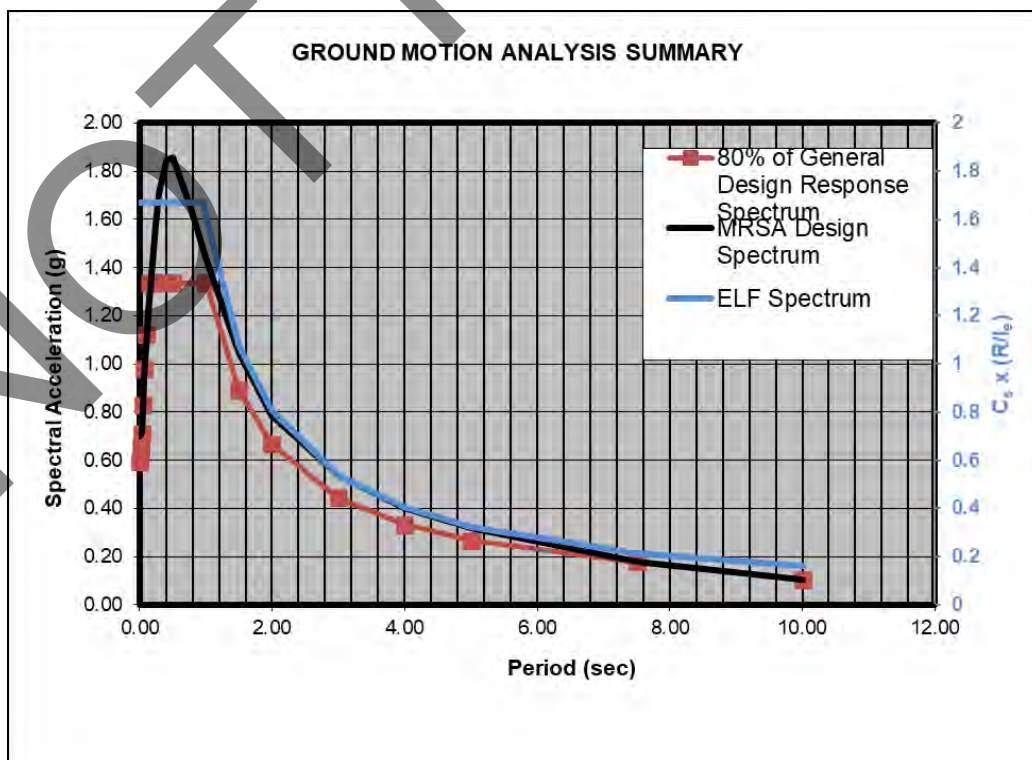
Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE_R)	Governing Method	
T	MCE_R	MCE_R			
0.010	1.05	1.25	1.05	Deterministic Governs	
0.020	1.06	1.26	1.06	Deterministic Governs	
0.030	1.09	1.31	1.09	Deterministic Governs	
0.050	1.21	1.52	1.21	Deterministic Governs	
0.075	1.42	1.88	1.42	Deterministic Governs	
0.100	1.61	2.36	1.61	Deterministic Governs	
0.150	1.90	2.49	1.90	Deterministic Governs	
0.200	2.13	2.73	2.13	Deterministic Governs	
0.250	2.37	2.96	2.37	Deterministic Governs	
0.300	2.56	3.13	2.56	Deterministic Governs	
0.400	2.77	3.23	2.77	Deterministic Governs	
0.500	2.78	3.17	2.78	Deterministic Governs	
0.750	2.49	2.73	2.49	Deterministic Governs	
1.000	2.16	2.30	2.16	Deterministic Governs	
1.500	1.57	1.58	1.57	Deterministic Governs	
2.000	1.18	1.18	1.18	Deterministic Governs	
3.000	0.84	0.81	0.81	Probabilistic Governs	
4.000	0.63	0.60	0.60	Probabilistic Governs	
5.000	0.49	0.48	0.48	Probabilistic Governs	
7.500	0.26	0.26	0.26	Deterministic Governs	
10.000	0.15	0.16	0.15	Deterministic Governs	

These are plotted in the following diagram:



◆ **Design Response Spectrum (ASCE 7 Section 21.3)-**

In accordance with Section 21.3, the Design Response Spectrum was developed by the following equation: $S_a = 2/3S_{aM}$, where S_{aM} is the MCE_R spectral response acceleration obtained from Section 21.1 or 21.2. The design spectral response acceleration shall not be taken less than 80 percent of S_a . These are plotted and compared with 80% of the CBC Spectrum values in the following diagram:



◆ **Design Acceleration Parameters (ASCE 7 Section 21.4)-**

Where the site-specific procedure is used to determine the design ground motion in accordance with Section 21.3, the parameter S_{DS} shall be obtained from the site-specific spectra at a period of 0.2 s, except that it shall not be taken less than 90 percent of the peak spectral acceleration, S_a , at any period larger than 0.2 s. The parameter S_{D1} shall be taken as the greater of the products of $S_a * T$ for periods between 1 and 5 seconds. The parameters S_{MS} , and S_{M1} shall be taken as 1.5 times S_{DS} and S_{D1} , respectively. The values so obtained shall not be less than 80 percent of the values determined in accordance with Section 11.4.4 for S_{MS} , and S_{M1} and Section 11.4.5 for S_{DS} and S_{D1} .

◆ **Site Specific Design Parameters -**

For the 0.2 second period (S_{DS}), the maximum average acceleration for any period exceeding 0.2 seconds was 1.86g occurring at $T=0.50$ seconds. This was multiplied by 0.9 to produce a value of 1.67g making this the applicable value. A value of 1.62g was calculated for S_{D1} at a period of 1 second (ASCE 7-16, 21.4). For the MCE_R 0.2 second period, a value of 2.506g (S_{MS}) was computed, along with a value of 2.429g (S_{M1}) for the MCE_R 1.0 second period was also calculated (ASCE 7-16, 21.2.3).

◆ **Site-Specific MCE_G Peak Ground Accelerations (ASCE 7 Section 21.5)-**

The probabilistic geometric mean peak ground acceleration (2 percent probability of exceedance within a 50-year period) was calculated as 1.24g. The deterministic geometric mean peak ground acceleration (largest 84th percentile geometric mean peak ground acceleration for characteristic earthquakes on all known active faults within the site region) was calculated as 0.95g. The site-specific MCE_G peak ground acceleration was calculated to be **0.95g**, which was determined by using the lesser of the probabilistic (1.24g) or the deterministic (0.95g) geometric mean peak ground accelerations, but not taken as less than 80 percent of PGA_M (i.e., $1.14g \times 0.80 = 0.92g$).

SEISMIC DESIGN PARAMETERS SUMMARY

Project: San Bernardino County Fire Station #227 Latitude: 34.1601
 Project #: 244073-1 Longitude: -117.2866
 Date: 7/14/2024

CALIFORNIA BUILDING CODE CHAPTER 16/ASCE7-16

Mapped Acceleration Parameters per ASCE 7-16, Chapter 22

S_s	2.506	Figure 22-1
S_1	1.002	Figure 22-2

Site Class per Table 20.3-1

Site Class = D - Stiff Soil

Site Coefficients per ASCE 7-16 CHAPTER 11

F_a	1	Table 11.4-1	=	1	For Site Specific Analysis per ASCE7-16 21.3
F_v	1.7	Table 11.4-2	=	2.50	For Site Specific Analysis per ASCE7-16 21.3

Mapped Design Spectral Response Acceleration Parameters

S_{Ms}	2.506	Equation 11.4-1		2.506	For Site Specific Analysis per ASCE7-16 21.3
S_{M1}	1.703	Equation 11.4-2		2.505	For Site Specific Analysis per ASCE7-16 21.3

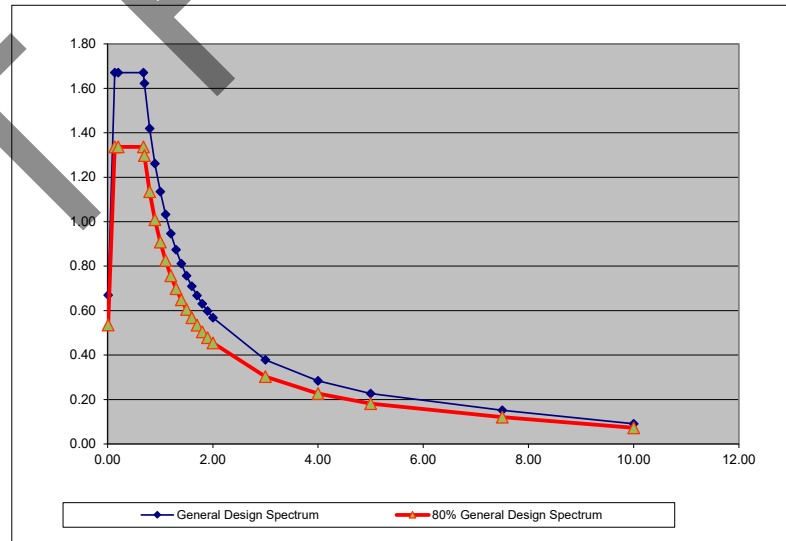
S_{DS}	1.671	Equation 11.4-3
S_{D1}	1.136	Equation 11.4-4

Period (T)	S_a (ASCE7-16 11.4.6)	80% General Design Spectrum
0.01	0.67	0.54
0.14	1.67	1.34
0.20	1.67	1.34
0.68	1.67	1.34
0.70	1.62	1.30
0.80	1.42	1.14
0.90	1.26	1.01
1.00	1.14	0.91
1.10	1.03	0.83
1.20	0.95	0.76
1.30	0.87	0.70
1.40	0.81	0.65
1.50	0.76	0.61
1.60	0.71	0.57
1.70	0.67	0.53
1.80	0.63	0.50
1.90	0.60	0.48
2.00	0.57	0.45
3.00	0.38	0.30
4.00	0.28	0.23
5.00	0.23	0.18
7.50	0.15	0.12
10.00	0.09	0.07

T_0	0.136	sec
T_S	0.680	sec
T_L	8	sec
PGA	1.04	g
F_{PGA}	1.1	
C_{RS}	0.905	
C_{R1}	0.884	

From Fig 22-12

From Table 11.8-1
 Figure 22-17
 Figure 22-18



ASCE 7-16 - RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION ANALYSIS

Use Maximum Rotated Horizontal Component? (Y/N)

Y

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relat Earthquake Rupture Forecast - UCERF3 Mean, FM 3.1 & 3.2

PROBABILISTIC MCER per 21.2.1.1 Method 1

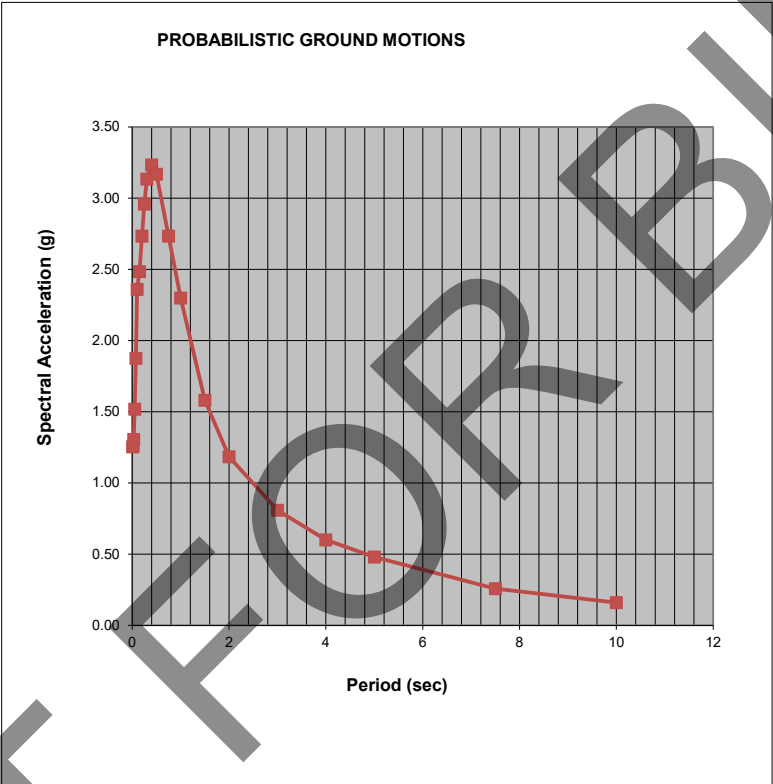
Risk Coefficients taken from Figures 22-18 and 22-19 of ASCE 7-16

OpenSHA data

2% Probability Of Exceedance in 50 years

Maximum Rotated Horizontal Component determined per ASCE7-16

T	Sa 2% in 50	MCER
0.01	1.39	1.25
0.02	1.39	1.26
0.03	1.44	1.31
0.05	1.68	1.52
0.08	2.07	1.88
0.10	2.37	2.36
0.15	2.75	2.49
0.20	3.02	2.73
0.25	3.27	2.96
0.30	3.47	3.13
0.40	3.59	3.23
0.50	3.53	3.17
0.75	3.07	2.73
1.00	2.60	2.30
1.50	1.79	1.58
2.00	1.34	1.18
3.00	0.92	0.81
4.00	0.68	0.60
5.00	0.54	0.48
7.50	0.29	0.26
10.00	0.18	0.16



S _s =	3.02	2.73
S ₁ =	2.60	2.30
PGA	1.24 g	

Risk Coefficients:		
C _{RS}	0.905	Figure 22-18
C _{R1}	0.884	Figure 22-19
F _a =	1	Table 11.4-1
Is Sa _(max) <1.2XF _a ?	NO	

Get from Mapped Values

Per ASCE7-16 - 21.2.3

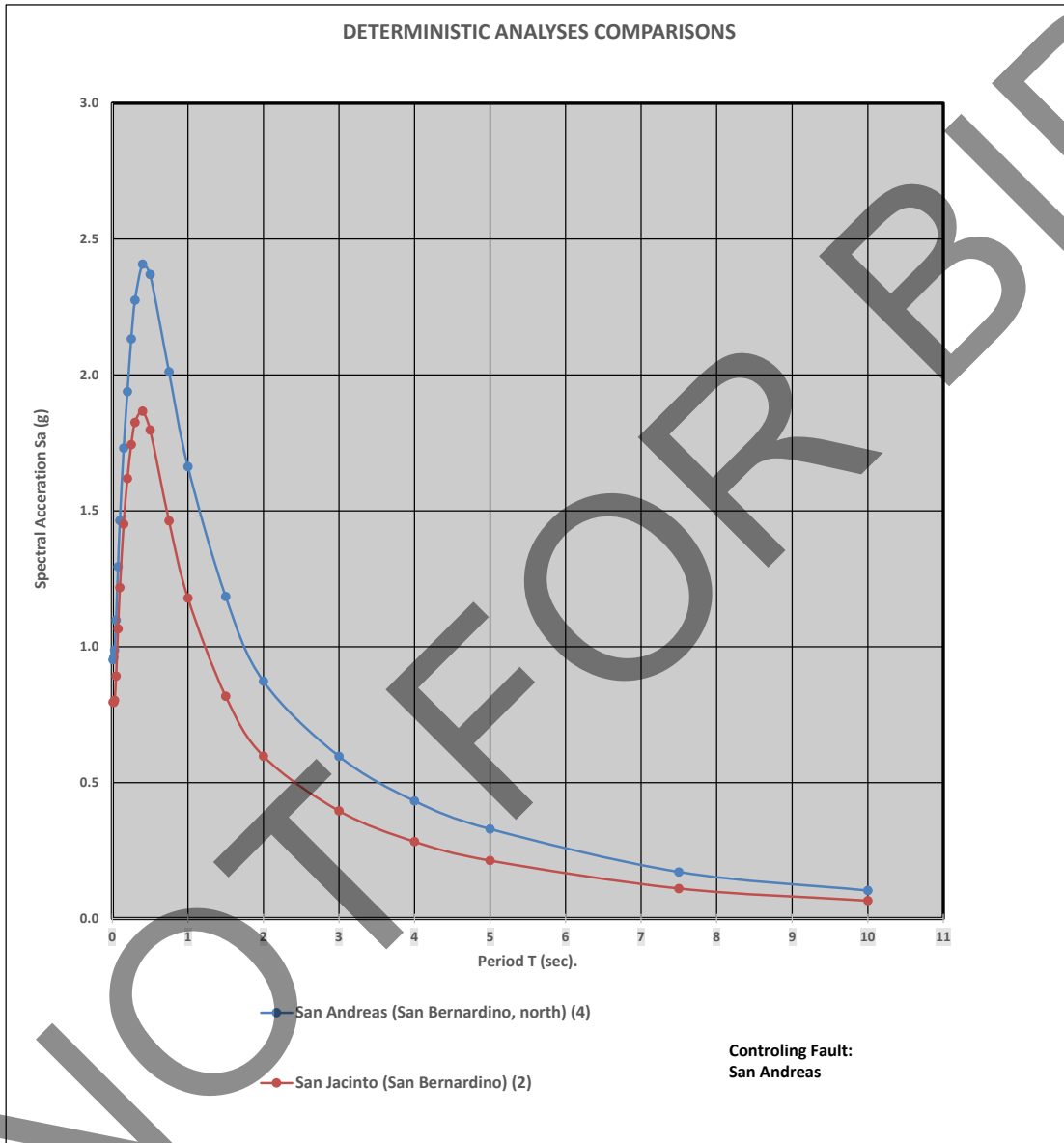
If "YES", Probabilistic Spectrum prevails

DETERMINISTIC MCE per 21.2.2

Preliminary Assessment:

Fault	Distance (km)
San Andreas (San Bernardino, north) (4)	1.80
San Jacinto (San Bernardino) (2)	6.30

The Probabilistic Analyses revealed 5 faults contributing more than 10% to the seismic hazard. These were considered in the Deterministic Analyses along with the Newport-Inglewood Fault.



Input Parameters		San Andreas (San Bernardino, north) (4)	San Jacinto (San Bernardino) (2)
Fault			
M	= Moment magnitude	8.1	7.8
R_{RUP}	= Closest distance to coseismic rupture (km)	1.8	6.3
R_{JB}	= Closest distance to surface projection of coseismic rupture (km)	1.8	6.3
R_x	= Horizontal distance to top edge of rupture measured perpendicular to strike (km)	1.8	6.3
U	= Unspecified Faulting Flag (Boore et.al.)	0	0
F_{RV}	= Reverse-faulting factor: 0 for strike slip, normal, normal-oblique; 1 for reverse, reverse-oblique and thrust	0	0
F_{NM}	= Normal-faulting factor: 0 for strike slip, reverse, reverse-oblique and thrust; 1 for normal and normal-oblique	0	0
F_{HW}	= Hanging-wall factor: 1 for site on down-dip side of top of rupture; 0 otherwise, used in AS08 and CY08	0	0
Z_{TOR}	= Depth to top of coseismic rupture (km)	0	0
δ	= Average dip of rupture plane (degrees)	90	90
V_{S30}	= Average shear-wave velocity in top 30m of site profile	327.7	327.7
F_{Measured}		1	1
Z_{1.0}	= Depth to Shear Wave Velocity of 1.0 km/sec (km)	0.25	0.25
Z_{2.5}	= Depth to Shear Wave Velocity of 2.5 km/sec (km)	0.35	0.35
Site Class		D	D
W (km)	= Fault rupture width (km)	12.5	16.5
F_{AS}	= 0 for mainshock; 1 for aftershock	0	0
σ	=Standard Deviation	1	1

Deterministic Summary - Section 21.2.2 (Supplement 1)

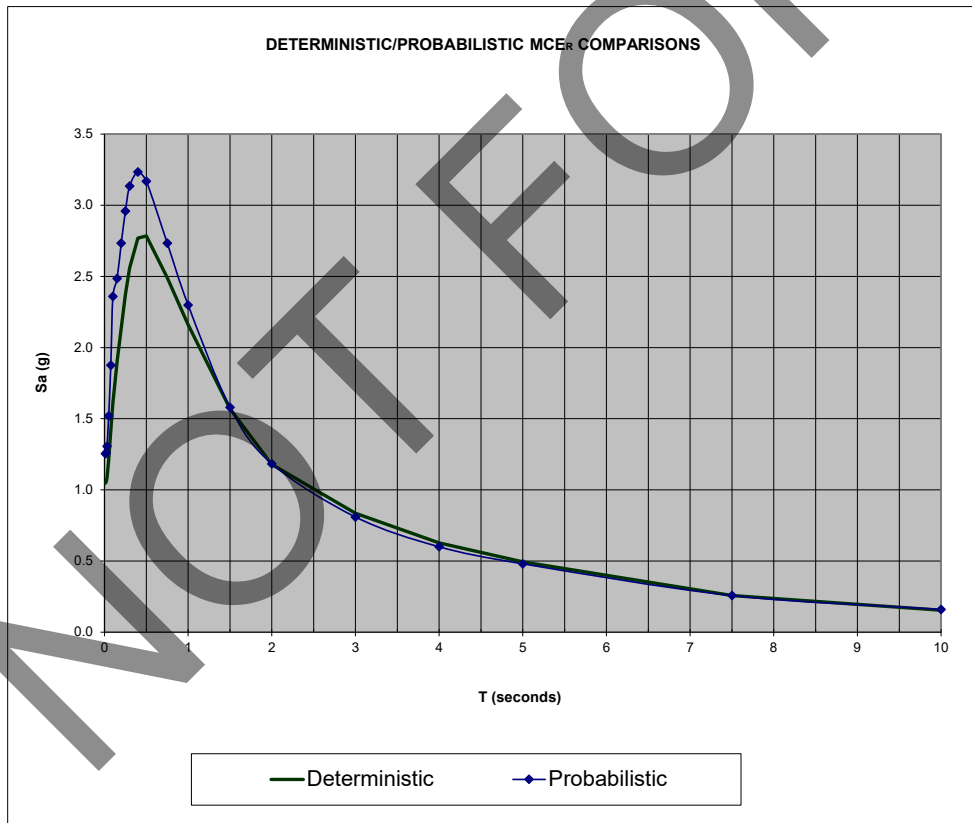
T	San Andreas (San Bernardino, north) (4)	San Jacinto (San Bernardino) (2)	Maximum S _a (Average)	Corrected* S _a (per ASCE7-16)	Scaled S _a (Average)	Controlling Fault
0.010	0.95	0.80	0.95	1.05	1.05	San Andreas (San
0.020	0.96	0.79	0.96	1.06	1.06	San Andreas (San
0.030	0.99	0.80	0.99	1.09	1.09	San Andreas (San
0.050	1.10	0.89	1.10	1.21	1.21	San Andreas (San
0.075	1.29	1.07	1.29	1.42	1.42	San Andreas (San
0.100	1.46	1.22	1.46	1.61	1.61	San Andreas (San
0.150	1.73	1.45	1.73	1.90	1.90	San Andreas (San
0.200	1.94	1.62	1.94	2.13	2.13	San Andreas (San
0.250	2.13	1.74	2.13	2.37	2.37	San Andreas (San
0.300	2.28	1.83	2.28	2.56	2.56	San Andreas (San
0.400	2.41	1.87	2.41	2.77	2.77	San Andreas (San
0.500	2.37	1.80	2.37	2.78	2.78	San Andreas (San
0.750	2.01	1.46	2.01	2.49	2.49	San Andreas (San
1.000	1.66	1.18	1.66	2.16	2.16	San Andreas (San
1.500	1.19	0.82	1.19	1.57	1.57	San Andreas (San
2.000	0.87	0.60	0.87	1.18	1.18	San Andreas (San
3.000	0.60	0.40	0.60	0.84	0.84	San Andreas (San
4.000	0.43	0.28	0.43	0.63	0.63	San Andreas (San
5.000	0.33	0.21	0.33	0.49	0.49	San Andreas (San
7.500	0.17	0.11	0.17	0.26	0.26	San Andreas (San
10.000	0.10	0.07	0.10	0.15	0.15	San Andreas (San
PGA	0.95	0.76	0.95		0.95	g
Max Sa=	2.78					
Fa =	1.00					Per ASCE7-16 21.2.2
1.5XFa=	1.5					
Scaling Factor=	1.00					

* Correction is the adjustment for Maximum Rotated Value if Applicable

SITE SPECIFIC MCE_R - Compare Deterministic MCE_R Values (S_a) with Probabilistic MCE_R Values (S_a) per 21.2.3

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relat

Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE_R)	Governing Method
T	MCE_R	MCE_R		
0.010	1.05	1.25	1.05	Deterministic Governs
0.020	1.06	1.26	1.06	Deterministic Governs
0.030	1.09	1.31	1.09	Deterministic Governs
0.050	1.21	1.52	1.21	Deterministic Governs
0.075	1.42	1.88	1.42	Deterministic Governs
0.100	1.61	2.36	1.61	Deterministic Governs
0.150	1.90	2.49	1.90	Deterministic Governs
0.200	2.13	2.73	2.13	Deterministic Governs
0.250	2.37	2.96	2.37	Deterministic Governs
0.300	2.56	3.13	2.56	Deterministic Governs
0.400	2.77	3.23	2.77	Deterministic Governs
0.500	2.78	3.17	2.78	Deterministic Governs
0.750	2.49	2.73	2.49	Deterministic Governs
1.000	2.16	2.30	2.16	Deterministic Governs
1.500	1.57	1.58	1.57	Deterministic Governs
2.000	1.18	1.18	1.18	Deterministic Governs
3.000	0.84	0.81	0.81	Probabilistic Governs
4.000	0.63	0.60	0.60	Probabilistic Governs
5.000	0.49	0.48	0.48	Probabilistic Governs
7.500	0.26	0.26	0.26	Deterministic Governs
10.000	0.15	0.16	0.15	Deterministic Governs



DESIGN RESPONSE SPECTRUM per Section 21.3

DESIGN ACCELERATION PARAMETERS per Section 21.4 (MRSA)

Period	$2/3 \cdot MCE_R$	80% General Design Response Spectrum (per ASCE 7-16 23.3-1)	Design Response Spectrum	TXSa
0.01	0.70	0.57	0.70	
0.02	0.71	0.61	0.71	
0.03	0.72	0.65	0.72	
0.05	0.81	0.74	0.81	
0.08	0.95	0.84	0.95	
0.10	1.07	0.94	1.07	
0.15	1.27	1.14	1.27	
0.20	1.42	1.34	1.42	
0.25	1.58	1.34	1.58	
0.30	1.71	1.34	1.71	
0.40	1.85	1.34	1.85	
0.50	1.86	1.34	1.86	
0.75	1.66	1.34	1.66	
1.00	1.44	1.34	1.44	1.44
1.50	1.05	0.89	1.05	1.57
2.00	0.79	0.67	0.79	1.57
3.00	0.54	0.45	0.54	1.62
4.00	0.40	0.33	0.40	1.60
5.00	0.32	0.27	0.32	1.60
7.50	0.17	0.18	0.18	
10.00	0.10	0.11	0.11	

Highest value of S_a for any period exceeding 0.2 sec. =

90% of Highest Value =

80% of Mapped S_{DS} =

Maximum TXSa from $T=1s-5s$ =

80% of Mapped S_{D1} =

1.86

1.67

1.34

1.62

0.91

S_{DS} =	1.67
S_{D1} =	1.62
T_s =	0.97

S_{MS} =	2.506
S_{M1} =	2.429

PGA Determination:

Site Coefficient F_{PGA} =

Mapped PGA =

PGA_M =

1.1

1.04

1.14 g

Figure 22-7

Deterministic PGA =

Probabilistic PGA =

Lesser of Deterministic/Probabilistic =

80% of PGA_M =

MCE_G PGA =

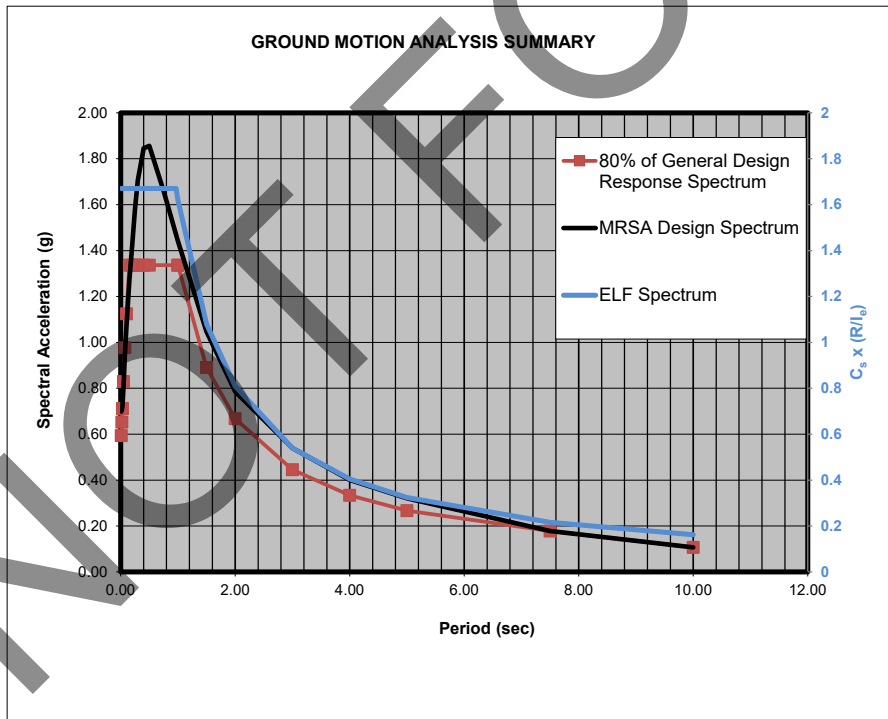
0.95 g

1.24 g

0.95 g

0.92 g

0.95 g



SUMMARY OF SITE SPECIFIC GROUND MOTION HAZARD ANALYSIS DATA

1	2	3		4	5	6	7	8	9	10	11	12
Period (sec)	Mapped MCE _R Spectrum	Mapped Design Spectrum	Period (sec)	Risk Coefficient C _R	Scaled MCE _R Deterministic Spectrum	Probabilistic MCE _R Spectrum	Probabilistic w/Risk Coefficient C _R	84th Percentile Deterministic Spectrum	2/3 Site Specific MCE _R Spectrum	80% of General Design Spectrum	Site Specific MCE _R Spectrum	Design Response Spectrum
0.01	1.00	0.67	0.01	0.905	1.05	1.25	1.25	1.05	0.70	0.57	1.05	0.70
0.14	2.51	1.67	0.02	0.905	1.06	1.26	1.26	1.06	0.71	0.61	1.06	0.71
0.20	2.51	1.67	0.03	0.905	1.09	1.31	1.31	1.09	0.72	0.65	1.09	0.72
0.68	2.51	1.67	0.05	0.905	1.21	1.52	1.52	1.21	0.81	0.74	1.21	0.81
0.70	2.43	1.62	0.08	0.905	1.42	1.88	1.88	1.42	0.95	0.84	1.42	0.95
0.80	2.13	1.42	0.10	0.905	1.61	2.36	2.36	1.61	1.07	0.94	1.61	1.07
0.90	1.89	1.26	0.15	0.905	1.90	2.49	2.49	1.90	1.27	1.14	1.90	1.27
1.00	1.70	1.14	0.20	0.905	2.13	2.73	2.73	2.13	1.42	1.34	2.13	1.42
1.10	1.55	1.03	0.25	0.904	2.37	2.96	2.96	2.37	1.58	1.34	2.37	1.58
1.20	1.42	0.95	0.30	0.902	2.56	3.13	3.13	2.56	1.71	1.34	2.56	1.71
1.30	1.31	0.87	0.40	0.900	2.77	3.23	3.23	2.77	1.85	1.34	2.77	1.85
1.40	1.22	0.81	0.50	0.897	2.78	3.17	3.17	2.78	1.86	1.34	2.78	1.86
1.50	1.14	0.76	0.75	0.891	2.49	2.73	2.73	2.49	1.66	1.34	2.49	1.66
1.60	1.06	0.71	1.00	0.884	2.16	2.30	2.30	2.16	1.44	1.34	2.16	1.44
1.70	1.00	0.67	1.50	0.884	1.57	1.58	1.58	1.57	1.05	0.89	1.57	1.05
1.80	0.95	0.63	2.00	0.884	1.18	1.18	1.18	1.18	0.79	0.67	1.18	0.79
1.90	0.90	0.60	3.00	0.884	0.84	0.81	0.81	0.84	0.54	0.45	0.81	0.54
2.00	0.85	0.57	4.00	0.884	0.63	0.60	0.60	0.63	0.40	0.33	0.60	0.40
3.00	0.57	0.38	5.00	0.884	0.49	0.48	0.48	0.49	0.32	0.27	0.48	0.32
4.00	0.43	0.28	7.50	0.884	0.26	0.26	0.26	0.26	0.17	0.18	0.27	0.18
5.00	0.34	0.23	10.00	0.884	0.15	0.16	0.16	0.15	0.10	0.11	0.16	0.11
7.50	0.23	0.15										
10.00	0.14	0.09										

APPENDIX C

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September 6, 2024
Project No. S168-193

STK ARCHITECTURE, INC.
42095 Zeno Drive, Suite A15
Temecula, California 92590

Attention: Tony Finaldi

Subject: Geotechnical Investigation
Proposed Fire Station 227
NWC Genevieve Street N. and W. 38th Street
San Bernardino, California

Dear Mr. Finaldi:

This report presents the results of the geotechnical investigation for the proposed Fire Station 227. The investigation was conducted in general conformance with our proposal dated March 6, 2024.

This report includes project design and construction recommendations along with the field and laboratory data. The primary geotechnical issues are the potential for strong ground shaking and the presence of variable soil conditions within the building areas that will require removal and recompaction.

We appreciate the opportunity to work with you on this project. Please call if you have any questions or need any other information.

Sincerely,
INLAND FOUNDATION ENGINEERING, INC.

Allen D. Evans, P.E., G.E.
Principal

Christopher Hogan Rangel, PG
Project Geologist
ADE:CHR:sd



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INTRODUCTION

This report presents the results of the geotechnical investigation conducted for the proposed San Bernardino County Fire Station 227. Fire Station 227 will be located on the northwest corner of Genevieve Street N. and W. 38th Street in San Bernardino, California. Our project understanding was based on the discussions with STK Architecture and review of the following plan.

- FS 227 – Conceptual Site Plan, W. 38th Street, San Bernardino, CA, prepared by STK Architecture Inc, dated June 12, 2024

SCOPE OF SERVICE

The purpose of this geotechnical investigation was to provide geotechnical parameters for design and construction of the proposed project. The scope of the geotechnical services included:

- *Evaluation of existing geologic conditions at the site and review of potential geologic and seismic hazards.*
- *Evaluation of the local and regional tectonic setting and historical seismic activity, including a site-specific ground motion analysis.*
- *Reconnaissance of the site and surrounding area to ascertain the presence of unstable or adverse geologic conditions.*
- *Subsurface sampling and laboratory testing.*
- *Analysis of the data collected and the preparation of this report with geotechnical engineering conclusions and recommendations for design and construction.*

Evaluation of hazardous waste was not within the scope of services provided.

PROJECT DESCRIPTION

The Fire Station No. 227 project will consist of the construction of a new single-story structure comprising approximately 9,870 square feet. The station will be constructed on the southerly portion of the existing Arrowhead Elementary School property.

The fire station will include 3 truck bays, sleeping quarters for 8 crew members and will provide storage for 2 Type 1 Engines and a future ladder truck. A storage building and generator / fuel tank pad will be constructed in the northwest site area. Foundations for

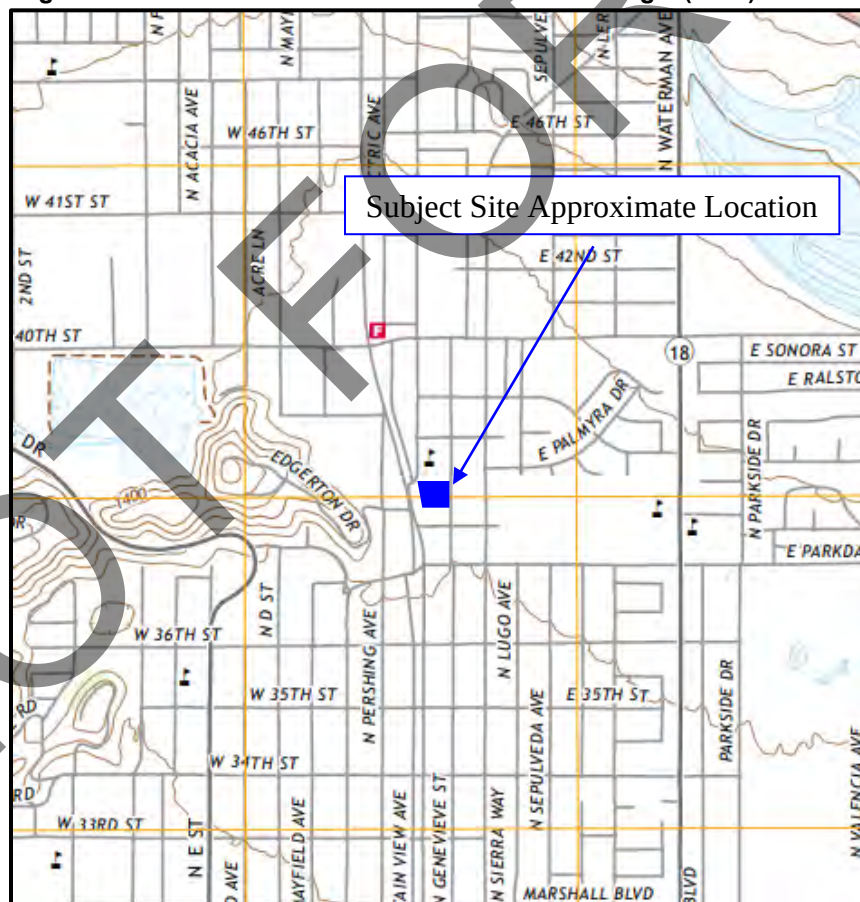
the proposed structures are expected to consist of shallow continuous and isolated concrete spread footings with slab-on-grade floors. Off-site improvements on Genevieve Street and 38th Street will be necessary. Site grading is expected to consist of minor cuts and fills of 2 to 3 feet, exclusive of remedial removals as recommended in this report.

Stormwater infiltration basins are planned in the southern and northwestern portions of the site. The basin depths are expected to be no deeper than five feet below existing surface grades.

SITE DESCRIPTION

The subject site is located on the northwest corner of Genevieve Street N. and W. 38th Street in San Bernardino, California (34.160118°, -117.286677°). The site occupies 1.21 acres and is currently covered with a grass field and large trees on the east, west and south sides. Figure 1 below shows the site location.

Figure 1: USGS San Bernardino North 7.5' Quadrangle (2021)



According to Google Earth, elevations at the site range from 1,279 to 1,283 feet above mean sea level (msl). The site slopes generally to the south at an overall rate of approximately 2 percent.

GEOLOGIC HAZARDS EVALUATION

A geologic hazards report for this project was prepared by our subconsultant, Terra Geosciences, and is appended. The engineering geology and seismicity review was performed using the suggested “Checklist for the Review of Geologic/Seismic Reports for California Public Schools, Hospitals and Essential Services Buildings” (California Geologic Survey, Note 48, 2022).

The geologic hazards study indicates that the proposed fire station and associated structures are considered feasible from a geologic standpoint, providing that the conclusions and recommendations presented in the report are considered during planning and construction. No adverse geologic conditions were found within the proposed construction area, with the exception of the potential for strong ground shaking from nearby seismogenic fault sources.

The geologic hazards study included a site-specific ground motion analysis. The mapped spectral acceleration parameters, coefficients, and other related seismic parameters were evaluated using the OSHPD Seismic Design Maps web application (OSHPD, 2020) and the California Building Code criteria (CBC, 2022), with the site-specific ground motion analysis being performed following Section 21 of the ASCE 7-16 Standard (2017). The results of the site-specific analysis are summarized and tabulated in Table 1 below:

Table 1: Seismic Design Parameters

Factor or Coefficient	Value
S_s	2.506g
S_1	1.002g
F_a	1.2g
F_v	1.7g
S_{DS}	1.670g
S_{D1}	1.620g
S_{MS}	2.506g
S_{M1}	2.429g
T_L	8 Seconds
MCE_G PGA	0.95g
Site Class	D

SUBSURFACE CONDITIONS

Subsurface exploration at the site consisted of four (4) exploratory borings to depths ranging from approximately 16.5 to 50.5 feet below existing site grades. The site exploration is described in Appendix A. Boring locations are shown on Figure A-7.

The soil encountered in the borings consisted of quaternary alluvial materials comprised of interlayered silty sand (SM), sand with silt and gravel (SP/SW-SM), and silty clayey sand (SC-SM). Cobbles and boulders were encountered in boring B-01 at a depth of 30.5 feet. The soil encountered was generally fine to very coarse grained, loose to very dense and in a slightly moist to moist state.

Corrosion Potential: Analytical testing indicates the concentration of sulfates is 52 ppm. In accordance with ACI 318, Table 4.2.1, the soil is classified as having a negligible sulfate exposure. The chloride concentration in the tested sample was 30 ppm and indicates that the soil is generally not corrosive with respect to ferrous metal. The soil is alkaline with a pH value of 8.5. The saturated minimum resistivity value of 7,790 ohm-cm indicates the soil may be moderately corrosive to buried ferrous metal. Alternative material such as PVC piping should be considered in the project design. Inland Foundation Engineering, Inc. does not practice corrosion engineering. A qualified corrosion engineer should be consulted for additional guidance.

Hydrocollapse Potential: Consolidation testing indicates that the soil is compressible and normally consolidated. The results show a slight to moderate potential for hydrocollapse when saturated under anticipated foundation and soil overburden loads. Provided that the building pad area is prepared as recommended herein, and appropriate surface drainage is provided in accordance with contemporary design practice, the potential for adverse building settlement due to hydrocollapse is not significant.

Expansive Soil: The site soil is granular, non-plastic, and non-expansive. Design measures to mitigate soil expansion are not necessary.

Groundwater: Groundwater was not encountered within the exploratory borings, which extended to a maximum depth of 50.5 feet below existing ground surface. Based on a review of pertinent groundwater data (referenced in appended geologic hazards report), the depth to the high groundwater mark in the general region is greater than 120 feet.

Liquefaction and Seismically-Induced Settlement: In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soil that can result in the settlement of buildings, ground failure, or other hazards. The main factors contributing to this phenomenon are: 1) cohesionless, granular soil with relatively low density (usually of Holocene age); 2) shallow ground water (generally less than 50 feet);

and 3) moderate to high seismic ground shaking. Based on current and historical groundwater levels of more than 120 feet below ground surface, the potential for soil liquefaction is not significant.

“Dry sand” settlement occurs in loose granular soil as a result of seismic ground shaking. The potential for “dry sand” settlement was evaluated using GeoSuite® software and Pradel’s method (1998). The results indicate a potential for seismically-induced “dry sand” settlement of less than 1 inch. The estimated differential seismic settlement is less than ½ inch over 30 feet. A discussion of the seismic settlement analysis, with graphic results, is included in Appendix D.

INFILTRATION TESTING

Infiltration testing was conducted in general accordance with Appendix D of the Technical Guidance Document for Water Quality Management Plans, prepared by CDM Smith for the County of San Bernardino Areawide Stormwater Program (2013). The shallow percolation test method was used per the Riverside County Department of Environmental Health guidelines. Four percolation tests were performed at the locations shown on Figure A-7. The testing procedures are described, and the test data is included in Appendix C of this report.

The test results are shown in Table 2. The corresponding calculated infiltration rate (I_c) ranges from 2.0 inches per hour to 5.7 inches per hour. These values exclude a factor of safety. The appropriate factor of safety should be determined by the design engineer.

Table 2: Infiltration Rate

Percolation Test No.	Percolation Rate (min/in)	Depth Below Ground Surface (in)	Infiltration Rate (I_c) (in/hr)
P-01	1.0	60	5.7
P-02	1.0	48	5.7
P-03	2.5	60	2.0
P-04	1.0	48	5.7

CONCLUSIONS AND RECOMMENDATIONS

The primary geotechnical issue that will require mitigation is the presence of loose compressible near surface soil conditions within the proposed structure areas. The near surface soil is not suitable for supporting foundations in its existing condition and should be over-excavated and recompacted. This and other geotechnical engineering recommendations for project design and construction are presented below.

Foundation Design: The proposed fire station and associated structures can be supported by shallow continuous and isolated spread footings designed with an allowable bearing pressure of 2,000 pounds per square foot (psf). Footings should have a minimum width of 12 inches and bottoms a minimum depth of 12 inches below the lowest adjacent grade. The allowable bearing pressure can be increased by 400 psf for each additional foot of width and by 800 psf for each additional foot of depth, to a maximum allowable bearing pressure of 4,000 psf. The allowable bearing pressure can be further increased by $\frac{1}{3}$ for short-term transient wind and seismic loads.

Static settlement of footings designed and constructed as recommended herein is expected to be less than one inch. Differential settlement between footings of similar size and load is expected to be less than one-half inch.

Lateral Resistance: Resistance to lateral loads will be provided by a combination of friction acting at the base of the slab or foundation and passive earth pressure. A coefficient of friction of 0.45 between soil and concrete may be used with dead load forces only. A passive earth pressure of 250 psf/ft may be used for the sides of footings poured against recompacted or dense native material. These values may be increased by $\frac{1}{3}$ for short-term transient wind and seismic loads. Passive earth pressure should be ignored within the upper one foot, except where confined as beneath a floor slab, for example.

Lateral Earth Pressure: Retaining walls should be designed for an active earth pressure equivalent to that exerted by a fluid weighing not less than 40 pcf. Any applicable construction or seismic surcharges should be added to this pressure. Retaining wall backfill should have an expansion index of less than 20.

Concrete Slabs-on-Grade: Concrete slabs-on-grade should have a minimum thickness of four inches. During final grading and prior to the placement of concrete, all surfaces to receive concrete slabs-on-grade should be compacted to maintain a minimum compacted fill thickness of 12 inches.

Load bearing slabs should be designed using a modulus of subgrade reaction (k) not exceeding 200 pounds per square inch per inch. This value is based on an applied foundation load area of 1.0 square foot. The k value should be reduced for larger foundation areas according to the following formula:

$$k_R = k * ((B+1) / 2B))^2$$

where k_R = reduced modulus of subgrade reaction
B = foundation width (feet)

Slabs should be designed and constructed in accordance with the provisions of the American Concrete Institute (ACI). Shrinkage of concrete should be anticipated and will result in cracks in all concrete slabs-on-grade. Shrinkage cracks may be directed to saw-cut "control joints" spaced on the basis of slab thickness and reinforcement.

Control joint spacing in unreinforced concrete at maximum intervals equal to the slab thickness times 24 is recommended.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder/barrier designed and constructed according to the American Concrete Institute 302.1 R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder/barrier construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage.

Portland Cement Concrete (PCC) Pavement: All surfaces that will support fire apparatus should be paved with Portland cement concrete (PCC). PCC pavement should consist of 9 inches of PCC over 6 inches of Class 2 aggregate base. The concrete should have a minimum 28-day modulus of rupture of 600 psi. This corresponds to a compressive strength of approximately 4,500 psi.

For all other areas that will utilize PCC pavement the below table can be utilized for design sections. The following Portland cement concrete pavement sections are based on the American Concrete Institute (ACI) Guide for Design and Construction of Concrete Parking Lots and Site Paving (ACI 330-21). The concrete to be utilized for Category A and B areas as well as pedestrian areas should have a minimum 28-day modulus of rupture of 500 psi. This corresponds to a compressive strength of approximately 2,500 psi. The actual pavement subgrade soil should be evaluated during construction to verify that the recommended pavement sections are appropriate.

Table 3: Portland Cement Concrete Pavement

Service	Concrete Thickness (in.)	Aggregate Base (in.)
Car parking and access lanes (Category A)	4.25	4.0
Entrance and truck service lanes (Category B)	5.25	4.0
Pedestrian, non-vehicular hardscape	4.0	0.0

The Class 2 aggregate base should comply with current Caltrans requirements. The aggregate base should be compacted to at least 95 percent relative compaction based on ASTM D1557. The upper 12 inches of pavement subgrade soil, below the aggregate base, should also be compacted to a minimum relative compaction of 95 percent.

The concrete pavement should be constructed with doweled joints and be restrained laterally by concrete curb/gutter or building foundations. The edges of the concrete should be protected from traffic loads by curbs or paved shoulders. If unrestrained pavement edges or non-doweled joints are desired, this firm should be contacted so that revised recommendations can be developed.

Construction joints should be sawcut in the pavement at a maximum spacing of 30 times the thickness of the slab, up to a maximum of 15 feet. Pavement sawcutting should be performed within 12 hours of concrete placement, preferably sooner. Sawcut depths should be equal to approximately $\frac{1}{4}$ of the slab thickness for conventional saws or one inch when early-entry saws are utilized on slabs nine inches thick or less. Construction joints should not be placed near flow lines. The use of plastic strips for formation of jointing is not recommended. The use of expansion joints is not recommended, except where the pavement will adjoin structures.

Asphalt Concrete Pavement: Recommended asphalt concrete structural pavement sections are shown below in Table 4.

Table 4: Asphalt Concrete Pavement

Service	Asphalt Concrete Thickness (ft.)	Base Course Thickness (ft.)
Light traffic (autos, parking areas, T.I. = 5.0)	0.25	0.35
Heavy traffic (trucks, driveways, T.I. = 7.0)	0.30	0.45

Inland Foundation Engineering, Inc. does not practice traffic engineering. The T.I. values used to develop the recommended pavement sections are typical for projects of this type. The project civil engineer or traffic engineer should review the T.I. values used to verify that they are appropriate for this project.

General Site Grading: All grading should be performed per the applicable provisions of the 2022 California Building Code and the following recommendations.

- 1. Clearing and Grubbing:** All building and pavement areas and all surfaces to receive compacted fill should be cleared of vegetation, debris, and other unsuitable materials. All such material should be disposed of off-site.

All undocumented artificial fill and loose native soil within the grading limits should be completely removed. Such material is suitable for use as compacted fill as recommended herein.

- 2. Preparation of Surfaces to Receive Compacted Fill:** All surfaces to receive compacted fill should be reviewed by a geologist or engineer from this firm prior

to processing. If roots or other deleterious materials are encountered or if the exposed excavation bottom is loose or unstable, additional over-excavation may be required until satisfactory conditions are encountered. Upon approval, surfaces to receive fill should be scarified to a minimum depth of eight inches, brought to near optimum moisture content, and compacted to a minimum of 90 percent relative compaction.

3. **Placement of Compacted Fill:** Fill materials consisting of on-site soil or approved imported granular soil should be spread in shallow lifts and compacted at near optimum moisture content to a minimum of 90 percent relative compaction, based on ASTM D1557. Fill placed within 10 feet of finish grade should not contain any particles larger than 12 inches (boulders). Boulder-size particles should be disposed of off-site or in designated rock disposal fill areas.
4. **Import Soil:** All proposed import soil should be tested prior to placement on the site to verify that it is not corrosive or expansive. Recommended import soil criteria are shown in the following Table 5.

Table 5: Recommended Import Soil Criteria

Sieve Size	Recommended Criteria
Percent Passing 3-Inch Sieve	100
Percent Passing No. 4 Sieve	85 – 100
Percent Passing No. 200 Sieve	15 – 40
Plasticity Index	Less than 15
Expansion Index (ASTM D4829)	20 or less (very low)
Organic content	Less than 1 percent by weight
Sulfates	< 1,000 ppm
Min. Resistivity	> 10,000 ohm-cm

5. **Preparation of Building Areas:** All proposed building areas should be over-excavated to a depth of at least 8 feet below existing grade or 24 inches below the bottom of the deepest footing, whichever is greater. Building area excavation should extend laterally for at least 5 feet outside of exterior building foundation lines. Following excavation, the exposed soil should be evaluated by this firm to verify it is suitable to receive compacted fill. The removed soil should be placed and compacted as recommended above. Soil within 5 feet of finish grade and within 2 feet of footing and slab bottoms should not contain any particles larger than 3 inches (cobbles).

- 6. Preparation of Paving Areas:** During final grading and immediately prior to the placement of aggregate base, all surfaces to receive asphalt concrete or Portland cement concrete paving should be processed to remove all particles larger than 3 inches within 12 inches of subgrade. The upper 12 inches of pavement subgrade should be tested to assure compaction for a depth of at least 12 inches. Compaction within proposed pavement areas should be to a minimum of 95 percent relative compaction for both the subgrade and base course.
- 7. Utility Trench Backfill:** Utility trench backfill consisting of the on-site soil types should be placed by mechanical compaction to a minimum of 90 percent relative compaction. This is with the exception of the upper 12 inches under pavement areas where the minimum relative compaction should be 95 percent. Jetting of the native soil is not recommended.
- 8. Testing and Observation:** During grading, tests and observations should be performed by a representative of this firm to verify that the grading is performed per the project specifications. Density testing should be performed per the current ASTM D1556 or ASTM D6938 test methods. The minimum acceptable degree of compaction should be 90 percent of the maximum dry density, based on ASTM D1557, except where superseded by more stringent requirements, such as beneath pavement. Where testing indicates insufficient density, additional compactive effort should be applied until retesting indicates satisfactory compaction.

LIMITATIONS

The findings and recommendations presented in this report are based on the soil conditions encountered at the boring locations. Should conditions be encountered during grading that appear to be different than those indicated by this report, this office should be notified.

This report was prepared for STK Architecture, Inc. for their use in the design of the proposed Fire Station No. 227. This report may only be used by STK Architecture, Inc. for this purpose. The use of this report by parties or for other purposes is not authorized without written permission by Inland Foundation Engineering, Inc. Inland Foundation Engineering, Inc. will not be liable for any projects connected with the unauthorized use of this report.

The recommendations of this report are considered to be preliminary. The final design parameters may only be determined or confirmed at the completion of site grading on the basis of observations made during the site grading operation. To this extent, this report is not considered to be complete until the completion of both the design process and the site preparation.

The information in this report represents professional opinions that have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No warranty, express or implied, is made.

REFERENCES

American Concrete Institute 318 (2019), Building Code Requirements for Structural Concrete.

American Society of Civil Engineers (ASCE), 2017, Minimum Design Loads and Associated Criteria for Buildings and other Structures, ASCE Standard 7-16, 889pp.

California Building Standards Commission, 2022, California Building Code (CBC), California Code of Regulations, Title 24, Part 2, Volume 2.

County of San Bernardino (2013), Areawide Stormwater Program, Technical Guidance Document for Water Quality Management Plans

Terra Geosciences, Geologic Hazards Report, San Bernardino County Fire Station 227, NWC of 38th Street and Genevieve Avenue, City of San Bernardino, California, Project No. 244073-1, dated July 20, 2024

United States Geologic Survey, San Bernardino North 7.5' Quadrangle (2021)

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APPENDIX A

SITE EXPLORATION

Four exploratory borings were drilled at the approximate locations shown on Figure A-7. The materials encountered during drilling were logged by a staff geologist. Boring logs are included with this report as Figures A-3 through A-6.

Representative undisturbed soil samples were obtained within the borings by driving a modified California split spoon sampler and thin-walled steel penetration sampler. Representative bulk soil samples were also obtained from the excavation cuttings. Samples were placed in moisture sealed containers and transported to our laboratory for further testing and evaluation. Laboratory tests results are discussed and included in Appendix B.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

PRIMARY DIVISIONS			GROUP SYMBOLS		SECONDARY DIVISIONS	
COARSE GRAINED SOILS MORE THAN HALF OF MATERIALS IS LARGER THAN #200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN) 5% FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
			GP		POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVEL WITH FINES	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN) 5% FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
			SP		POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
		SANDS WITH FINES	SM		SILTY SANDS, SAND-SILT MIXTURES	
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES	
FINE GRAINED SOILS MORE THAN HALF OF MATERIALS IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50		ML		INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
			OL		ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	HIGHLY ORGANIC SOILS		PT		PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS	
TYPICAL FORMATIONAL MATERIALS	SANDSTONES		SS			
	SILTSTONES		SH			
	CLAYSTONES		CS			
	LIMESTONES		LS			
	SHALES		SL			

CONSISTENCY CRITERIA BASES ON FIELD TESTS

RELATIVE DENSITY – COARSE – GRAIN SOIL			CONSISTENCY – FINE-GRAIN SOIL		TORVANE	POCKET ** PENETROMETER	* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM -1586 STANDARD PENETRATION TEST)
RELATIVE DENSITY	SPT * (# BLOWS/FT)	RELATIVE DENSITY (%)	CONSISTENCY	SPT* (# BLOWS/FT)	UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	
VERY LOOSE	<4	0-15	Very Soft	<2	<0.13	<0.25	
LOOSE	4-10	15-35	Soft	2-4	0.13-0.25	0.25-0.5	
MEDIUM DENSE	10-30	35-65	Medium Stiff	4-8	0.25-0.5	0.5-1.0	
DENSE	30-50	65-85	Stiff	8-15	0.5-1.0	1.0-2.0	** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ.FT. READ FROM POCKET PENETROMETER
VERY DENSE	>50	85-100	Very Stiff	15-30	1.0-2.0	2.0-4.0	
			Hard	>30	>2.0	>4.0	

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbled or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

EXPLANATION OF LOGS

LOG OF BORING B-01

DRILLING RIG Mobile B-61
 DRILLING METHOD Rotary Auger
 LOGGED BY FWC
 GROUND ELEVATION +/-

DATE DRILLED 7/11/24

HAMMER TYPE Auto-Trip
 HAMMER WEIGHT 140-lb.
 HAMMER DROP 30-inches
 BORING DIAMETER 8-inches

SUMMARY OF SUBSURFACE CONDITIONS				BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
	U.S.C.S.	GRAPHIC LOG	This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.						
	SM		GRASS, SILTY SAND, with trace gravel, fine to very coarse, very dark grayish-brown (10YR 3/2), moist, medium dense.			AU			
5	SP-SM		SAND with SILT and GRAVEL, fine to very coarse, gray-brown (2.5Y 5/2), slightly moist, medium dense.			SS AU	9 9	11	112
	SM		SAND with SILT and GRAVEL, fine to very coarse, gray-brown (2.5Y 5/2), slightly moist, medium dense.			SS	6 11	6	93
10	SW-SM		SILTY SAND, with trace gravel, fine to very coarse, very dark grayish-brown (10YR 3/2), moist, medium dense.			SS AU	8 13	5	113
	SW-SM		SAND with SILT and GRAVEL, fine to coarse, grayish-brown (10YR 5/2), slightly moist, medium dense.			SS	23 18	2	130
15	SC-SM		SILTY, CLAYEY SAND, very fine to fine, olive-brown (2.5Y 4/4), moist, medium dense.			SS	9 10	12	117
20	SW-SM		SAND with SILT and GRAVEL, fine to very coarse, light olive-brown (2.5Y 5/4), slightly moist, medium dense.			SS	18 25	5	114
25	SM		SILTY SAND, with trace gravel, very fine to fine, grayish-brown (2.5Y 5/2), moist, dense.			SPT	33 28	10	
	SW-SM		SAND with SILT and GRAVEL, fine to very coarse, gray-brown (2.5Y 5/2), slightly moist, medium dense.			SPT	30 50/3"	2	
30			COBBLES and BOULDERS, End of boring at 30.8 feet. No groundwater encountered. Backfilled with native soil.						



CLIENT STK Architecture, Inc.
 PROJECT NAME Fire Station #227
 PROJECT LOCATION NWC Genevieve St. & W. 38th St.
San Bernardino, CA
 PROJECT NUMBER S168-193

FIGURE NO.

A-3

LOG OF BORING B-02

DRILLING RIG Mobile B-61
 DRILLING METHOD Rotary Auger
 LOGGED BY FWC
 GROUND ELEVATION +/-

DATE DRILLED 7/11/24

HAMMER TYPE Auto-Trip
 HAMMER WEIGHT 140-lb.
 HAMMER DROP 30-inches
 BORING DIAMETER 8-inches

			SUMMARY OF SUBSURFACE CONDITIONS				BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.									
			<u>GRASS.</u>									
5	SM		<u>SILTY SAND</u> , with trace gravel, fine to medium, dark grayish-brown (10YR 5/2), moist, loose.					⊗	SS	6 6	5	109
								⊗	SS	4 5	9	106
10	SM		<u>SILTY SAND</u> , with trace gravel, fine to medium, light olive-brown (2.5Y 5/2), slightly moist, medium dense.					⊗	SS	8 12	3	109
								⊗	SS	6 8	8	110
15	SP-SM		<u>SAND with SILT</u> , fine to coarse, dark grayish-brown (10YR 4/2), moist, loose to medium dense.					⊗	SS	12 14	6	107
								⊗	SS	17 24	3	117
20	SW-SM		<u>SAND with SILT and GRAVEL</u> , fine to medium, grayish-brown (10YR 5/2), slightly moist, medium dense.					⊗	SPT	13 19	5	
25								⊗	SPT	35 50	3	
30								⊗	SPT	50	2	
35	GW		<u>GRAVEL with SAND</u> , fine to coarse, olive-gray (5Y 4/2), moist, dense.					⊗	SPT	50/5"	3	
		<u>SAND with SILT and GRAVEL</u> , fine to medium, olive-gray (5Y 5/2), slightly moist, dense.					⊗	SPT	31 50	3		
40							⊗	SPT	50/5"	7		
45												
50												
			End of boring at 50.5 feet. No groundwater encountered. Backfilled with native soil.									



CLIENT STK Architecture, Inc.
 PROJECT NAME Fire Station #227
 PROJECT LOCATION NWC Genevieve St. & W. 38th St.
San Bernardino, CA
 PROJECT NUMBER S168-193

FIGURE NO.

A-4

LOG OF BORING B-03

DRILLING RIG	<u>Mobile B-61</u>	DATE DRILLED	<u>7/11/24</u>	HAMMER TYPE	<u>Auto-Trip</u>
DRILLING METHOD	<u>Rotary Auger</u>	HAMMER WEIGHT	<u>140-lb.</u>	HAMMER DROP	<u>30-inches</u>
LOGGED BY	<u>FWC</u>	BORING DIAMETER	<u>8-inches</u>		
GROUND ELEVATION	<u>+/-</u>				

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
			GRASS,			AU			
			SILTY SAND, fine to medium, dark grayish-brown (2.5Y 4/2), slightly moist, loose.						
5	SM					SS	3 6	4	107
			- rootlets throughout -						
			SAND with SILT and GRAVEL, fine to coarse, light olive-brown (2.5Y 5/3), slightly moist, medium dense.			AU			
10	SP-SM					SS	8 11	3	108
			SILTY SAND, fine to coarse, brown (10YR 4/2), moist, medium dense.						
	SM						12 25	4	116
	SW-SM		SAND with SILT and GRAVEL, fine to coarse, light olive-brown (2.5Y 5/3), slightly moist, medium dense.						
15	SM		SILTY SAND with GRAVEL, fine to medium, light olive-brown (2.5Y 5/3), slightly moist, medium dense.						
			SAND with SILT and GRAVEL, fine to coarse, OLIVE-GRAY (5y 4/2), slightly moist, medium dense.			SS	10 14	5	113
20	SW-SM								
						SS	21 35	2	131
			End of boring at 21.5 feet. No groundwater encountered. Backfilled with native soil.						



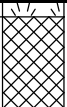
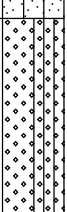
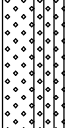
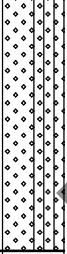
CLIENT	<u>STK Architecture, Inc.</u>
PROJECT NAME	<u>Fire Station #227</u>
PROJECT LOCATION	<u>NWC Genevieve St. & W. 38th St.</u>
	<u>San Bernardino, CA</u>
PROJECT NUMBER	<u>S168-193</u>

FIGURE NO.

A-5

LOG OF BORING B-04

DRILLING RIG	<u>Mobile B-61</u>	DATE DRILLED	<u>7/11/24</u>	HAMMER TYPE	<u>Auto-Trip</u>
DRILLING METHOD	<u>Rotary Auger</u>	HAMMER WEIGHT	<u>140-lb.</u>	HAMMER DROP	<u>30-inches</u>
LOGGED BY	<u>FWC</u>	BORING DIAMETER	<u>8-inches</u>		
GROUND ELEVATION	<u>+/-</u>				

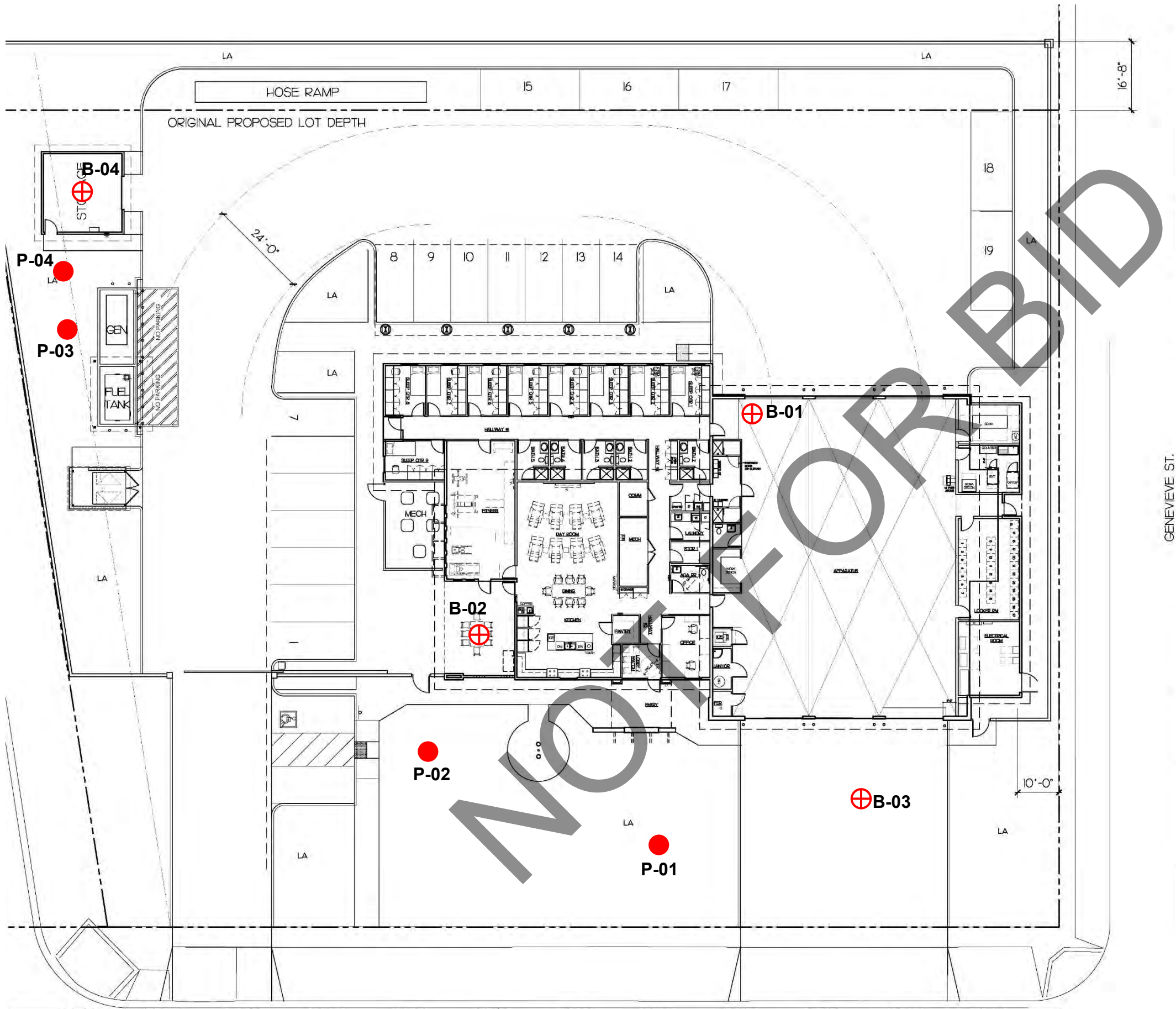
SUMMARY OF SUBSURFACE CONDITIONS												
DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.				BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
	SM		GRASS, ARTIFICIAL FILL, SILTY SAND, with trace gravel, fine to medium, grayish-brown (10YR 5/2), slightly moist, medium dense.						AU			
	SM		SILTY SAND, fine to coarse, grayish-brown (10YR 5/2), slightly moist, medium dense.						SS AU	16 18	3	110
5	SW-SM		SAND with SILT and GRAVEL, with trace gravel, fine to coarse, light olive-brown 2.5Y 5/4), slightly moist, medium dense.						SS	10 14	3	115
	SW-SM								SS	8 8	6	102
10	GW		GRAVEL with SAND, fine to coarse, light olive-brown (2.5Y 5/4), slightly moist, medium dense.						SS	11 14	3	115
	SW-SM		SAND with SILT and GRAVEL, with trace gravel, fine to coarse, light olive-brown 2.5Y 5/4), slightly moist, medium dense.						SS			
15	SW-SM								SS	22 31	4	
End of boring at 16.5 feet. No groundwater encountered. Backfilled with native soil.												



CLIENT	<u>STK Architecture, Inc.</u>
PROJECT NAME	<u>Fire Station #227</u>
PROJECT LOCATION	<u>NWC Genevieve St. & W. 38th St.</u> <u>San Bernardino, CA</u>
PROJECT NUMBER	<u>S168-193</u>

FIGURE NO.

A-6



SITE PLAN
STK Architecture, Inc.
Proposed Fire Station 227
NWC Genevieve Street N. and W. 38th Street
San Bernardino County, California

- LEGEND**
- Approximate Location of Exploratory Boring - ⊕
 - Approximate Location of Percolation Test - ●

Base Map: Prepared by STK Architecture, Inc.



IFE Inland Foundation Engineering, Inc. 1310 S. Santa Fe Avenue, San Jacinto, CA 92583 (951) 654-1555		
Figure A-7	STK Architecture, Inc. Proposed Fire Station 227 San Bernardino County, California	
	Drawn By: HR	Project No. S168-193
	Not to Scale	Date: August 2024

***APPENDIX B –
Laboratory Testing***

NOT FOR BID

APPENDIX B

LABORATORY TESTING

Representative soil samples obtained from our borings were delivered to our laboratory. Descriptions of the tests performed are provided below. Results of the testing are appended.

Unit Weight and Moisture Content: Ring samples were weighed and measured to evaluate their unit weight. A small portion of each sample was then tested for moisture content. The testing was performed per ASTM D2937 and D2216. The results of this testing are shown on the boring logs (Figures A-3 through A-6).

Maximum Density-Optimum Moisture: One sample was selected for maximum density testing in accordance with ASTM D1557. The maximum density is compared to the in-situ density of the soil to evaluate the relative compaction of the soil. The results of the testing are shown on Figure B-3.

Sieve Analysis: Ten soil samples were selected for sieve analysis testing in accordance with ASTM D6913. These tests provide information for classifying the soil in accordance with the Unified Classification System. This classification system categorizes the soil into groups having similar engineering characteristics. The results of the testing are shown on Figures B-4 and B-5.

Plastic Index: Two samples were selected for plastic index testing in accordance with ASTM D4318. These tests provide information regarding soil plasticity and are also used for developing classifications for the soil in accordance with the Unified Classification System. The results of the testing are shown on Figures B-4 and B-5.

Consolidation Testing: Two samples were selected for consolidation testing in accordance with ASTM D2435. This test is used to evaluate the magnitude and rate of settlement of a structure or earth fill. The results of this testing are presented graphically on Figure B-6.

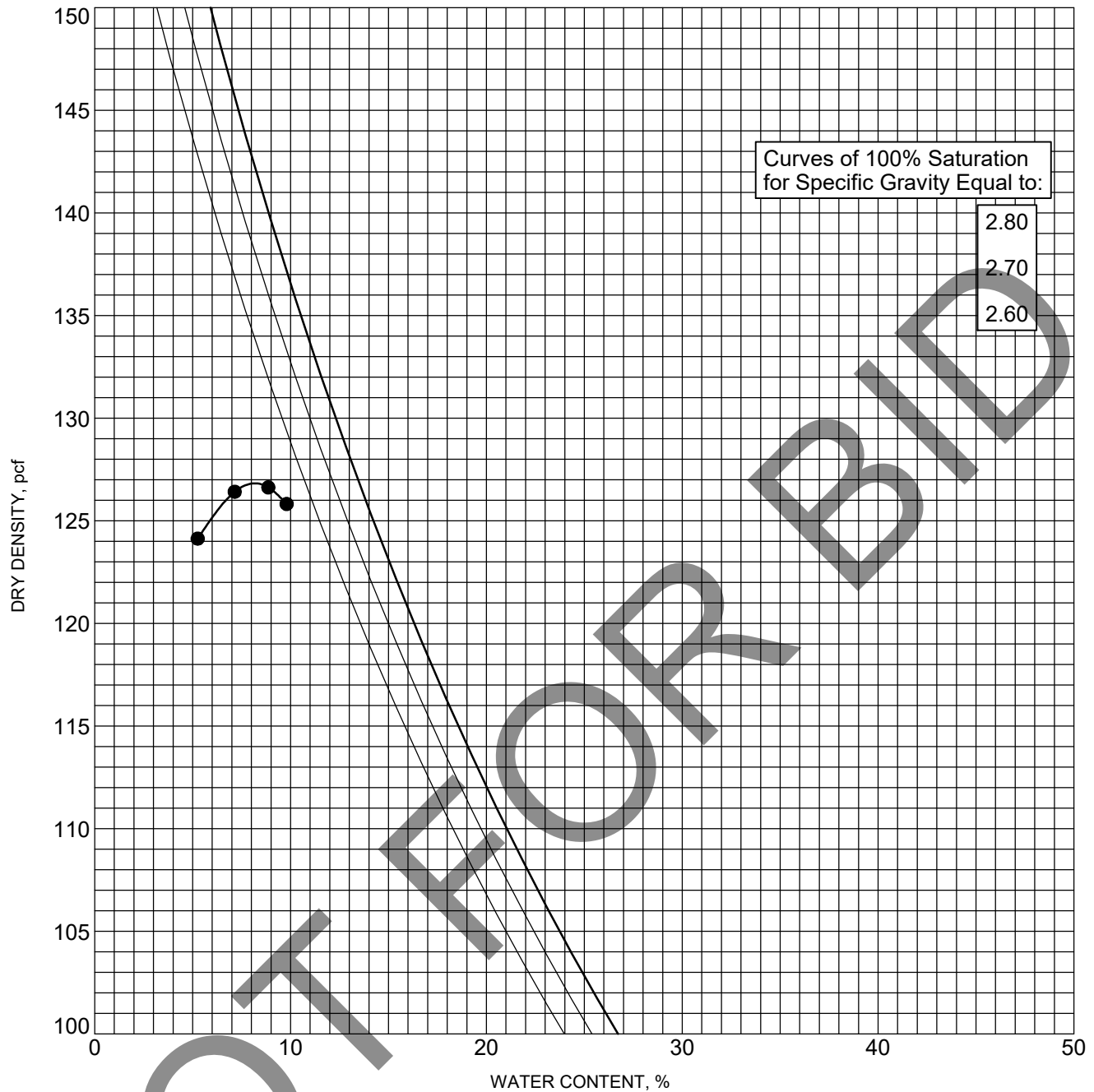
Direct Shear Strength: Two samples were selected and transported to AP Engineering and Testing in Pomona, California for direct shear strength testing in accordance with ASTM D3080. This testing measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation bearing capacity and lateral earth pressure. Test results are shown on Figures B-7 and B-8.

Corrosion Testing: One sample was selected and transported to AP Engineering and Testing in Pomona, California to evaluate the concentration of soluble sulfates and chlorides, pH level, and resistivity of and within the on-site soils. The test results are shown on Figure B-9.

R-value: One sample was selected for R-value and delivered to Terracon in Colton, California for testing in accordance with ASTM D2844. This test measures the potential strength of subgrade, subbase, and base course materials for use in pavements. Test results are shown on Figure No. B-10.

NOT FOR BID

IFE COMPACTION - GINT STD US LAB.GDT - 8/20/24 15:31 - P:\S168\S168-193 SB FS 227\GINT.GPJ



BOREHOLE	DEPTH	Description of Materials	Max DD	Optimum WC
● B-01	0.0	SILTY SAND with GRAVEL(SM)	126.8 PCF	8.1 %

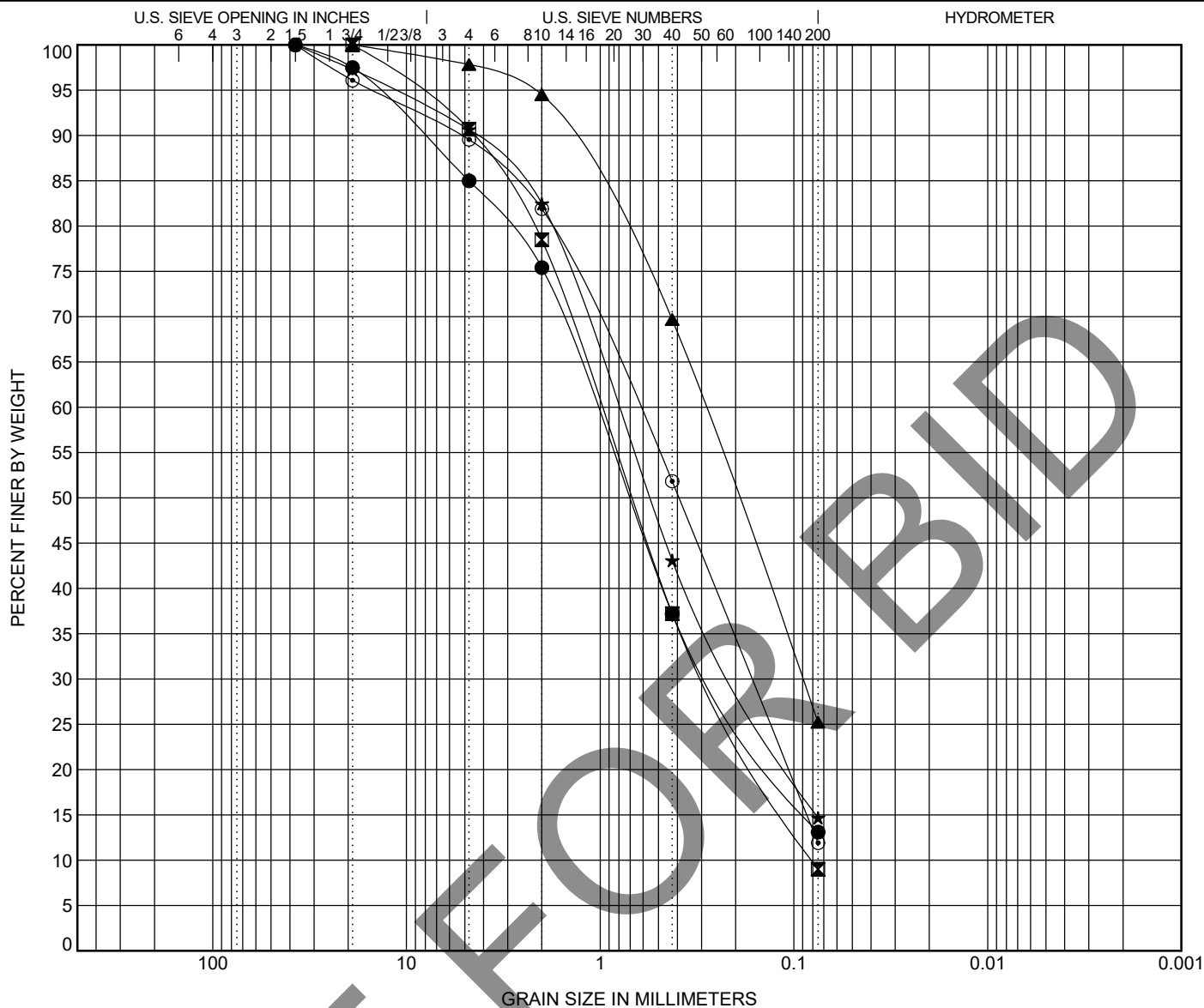
MOISTURE-DENSITY CURVES (ASTM D1557)

INLAND FOUNDATION ENGINEERING, INC.

FIGURE NO. B-3

CLIENT	STK Architecture, Inc.	PROJECT NAME	Fire Station #227
PROJECT NUMBER	S168-193	PROJECT LOCATION	NWC Genevieve St. & W. 38th St. San Bernardino, CA

IFE SIEVE ANALYSIS - GINT STD US LAB.GDT - 8/20/24 15:29 - P:\S168\S168-193 SB FS 227\GINT.GPJ



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SAMPLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-01	0.0	SILTY SAND with GRAVEL(SM)					NP	NP	NP		
⊠ B-01	4.5	POORLY GRADED SAND with SILT(SP-SM)					NP	NP	NP	0.93	12.53
▲ B-02	0.3	SILTY SAND(SM)					NP	NP	NP		
★ B-02	8.0	SILTY SAND(SM)					NP	NP	NP		
⊙ B-02	12.5	POORLY GRADED SAND with SILT(SP-SM)					NP	NP	NP	0.61	9.38
BOREHOLE	DEPTH	D100	D90	D50	D10	%Gravel	%Sand	%Silt		%Clay	
● B-01	0.0	37.5	8.278	0.714		15.0	71.9	13.1			
⊠ B-01	4.5	19	4.517	0.687	0.08	9.3	81.7	9.0			
▲ B-02	0.3	19	1.51	0.197		2.2	72.6	25.2			
★ B-02	8.0	37.5	4.43	0.558		9.3	76.0	14.7			
⊙ B-02	12.5	37.5	5.223	0.393		10.4	77.6	11.9			

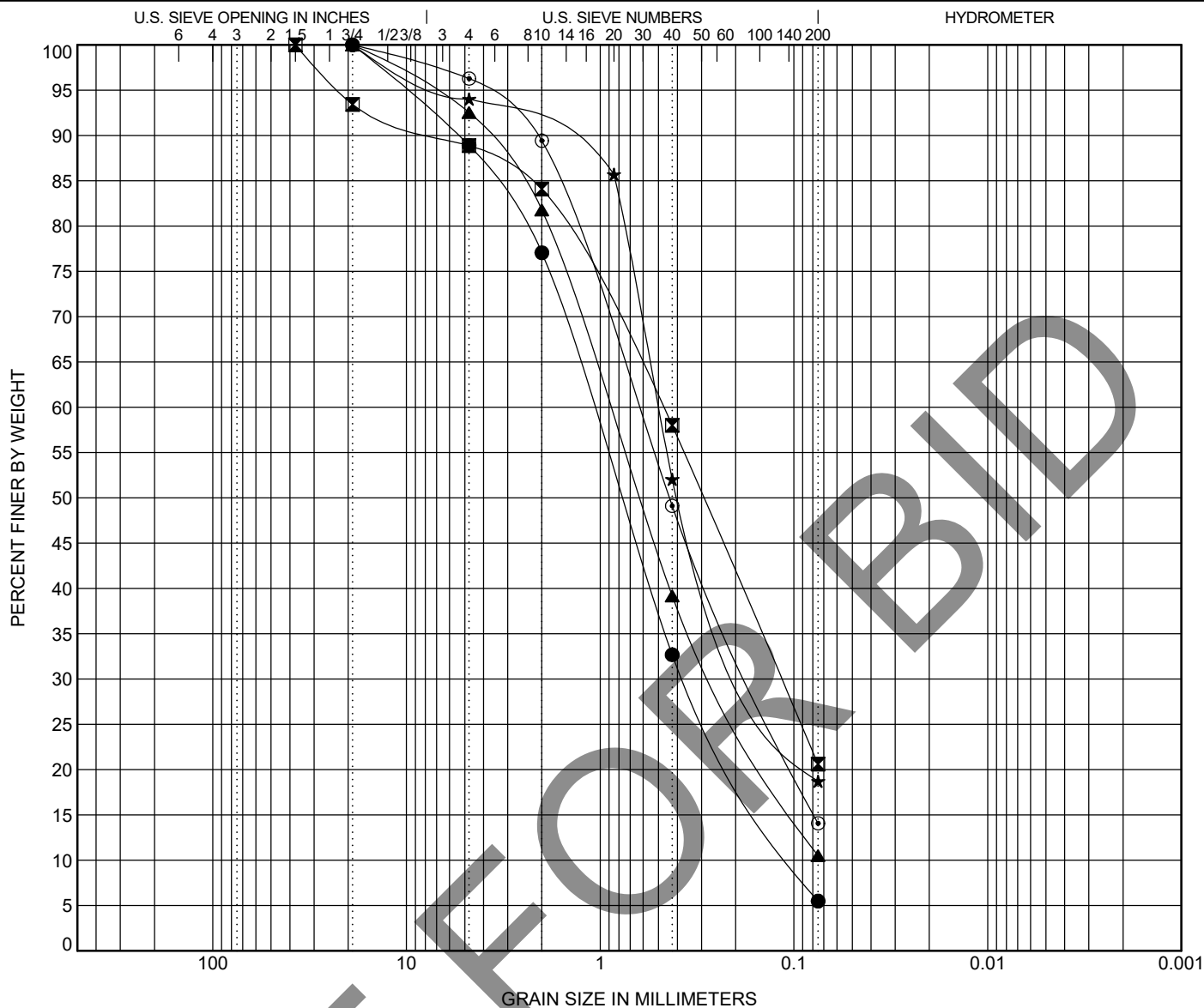
GRADATION CURVES (ASTM D6913, ASTM D4318)

INLAND FOUNDATION ENGINEERING, INC.

FIGURE NO. B-4

CLIENT	STK Architecture, Inc.	PROJECT NAME	Fire Station #227
PROJECT NUMBER	S168-193	PROJECT LOCATION	NWC Genevieve St. & W. 38th St.
			San Bernardino, CA

IFE SIEVE ANALYSIS - GINT STD US LAB.GDT - 8/20/24 15:29 - P:\S168\S168-193 SB FS 227\GINT.GPJ



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

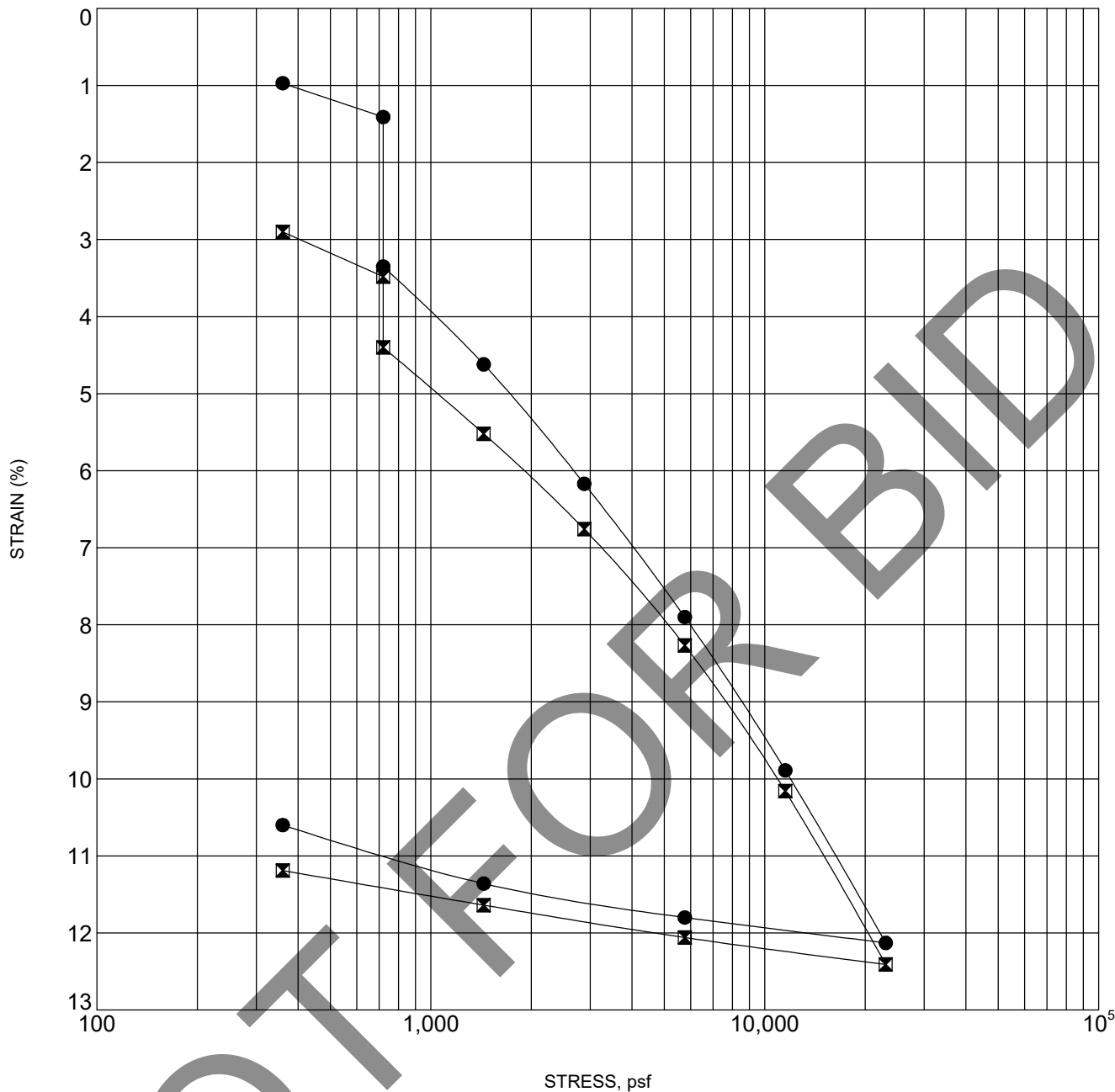
SAMPLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-02	20.5	WELL-GRADED SAND with SILT(SW-SM)					NP	NP	NP	1.16	11.03
☒ B-03	0.3	SILTY SAND(SM)					NP	NP	NP		
▲ B-03	7.8	POORLY GRADED SAND with SILT(SP-SM)					NP	NP	NP	0.90	12.46
★ B-04	0.3	SILTY SAND(SM)					NP	NP	NP		
◎ B-04	2.0	SILTY SAND(SM)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D90	D50	D10	%Gravel	%Sand	%Silt		%Clay	
● B-02	20.5	19	5.451	0.778	0.1	11.1	83.4	5.5			
☒ B-03	0.3	37.5	6.699	0.293		11.1	68.2	20.6			
▲ B-03	7.8	19	3.874	0.63		7.5	82.0	10.5			
★ B-04	0.3	19	2.069	0.382		6.0	75.3	18.7			
◎ B-04	2.0	19	2.151	0.44		3.7	82.2	14.1			

GRADATION CURVES (ASTM D6913, ASTM D4318)

INLAND FOUNDATION ENGINEERING, INC.

FIGURE NO. B-5

CLIENT	STK Architecture, Inc.	PROJECT NAME	Fire Station #227
PROJECT NUMBER	S168-193	PROJECT LOCATION	NWC Genevieve St. & W. 38th St.
			San Bernardino, CA



BOREHOLE	DEPTH	Classification	γ_d	MC%
● B-02	6.5			
✕ B-03	5.5			

CONSOLIDATION TEST (ASTM D2435)

INLAND FOUNDATION ENGINEERING, INC.

FIGURE NO. B-6

CLIENT	<u>STK Architecture, Inc.</u>	PROJECT NAME	<u>Fire Station #227</u>
PROJECT NUMBER	<u>S168-193</u>	PROJECT LOCATION	<u>NWC Genevieve St. & W. 38th St.</u>
			<u>San Bernardino, CA</u>



DIRECT SHEAR TEST RESULTS ASTM D 3080

Project Name: STK - Fire Station 227
Project No.: 5163-193
Boring No.: B-02
Sample No.: - Depth (ft): 3.5-4.5
Sample Type: Mod. Cal.
Soil Description: Silty Sand
Test Condition: Inundated Shear Type: Regular

Tested By: ST Date: 08/02/24
Computed By: JP Date: 08/07/24
Checked by: AP Date: 08/07/24

Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Initial Degree Saturation (%)	Final Degree Saturation (%)	Normal Stress (ksf)	Peak Shear Stress (ksf)	Ultimate Shear Stress (ksf)
110.0	106.4	3.4	19.3	16	89	1	0.744	0.684
						2	1.476	1.380
						3	2.148	1.956

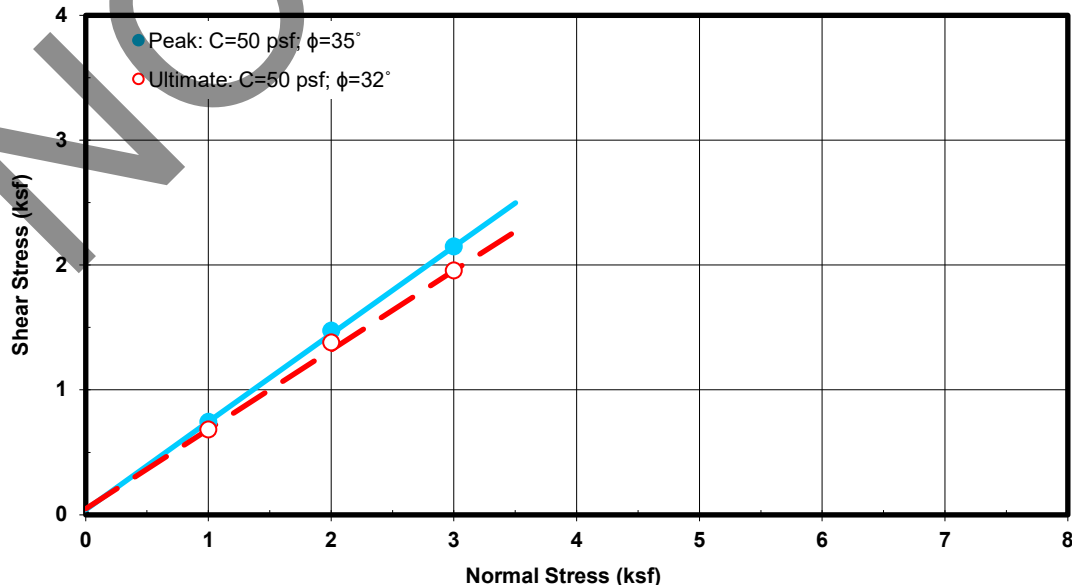
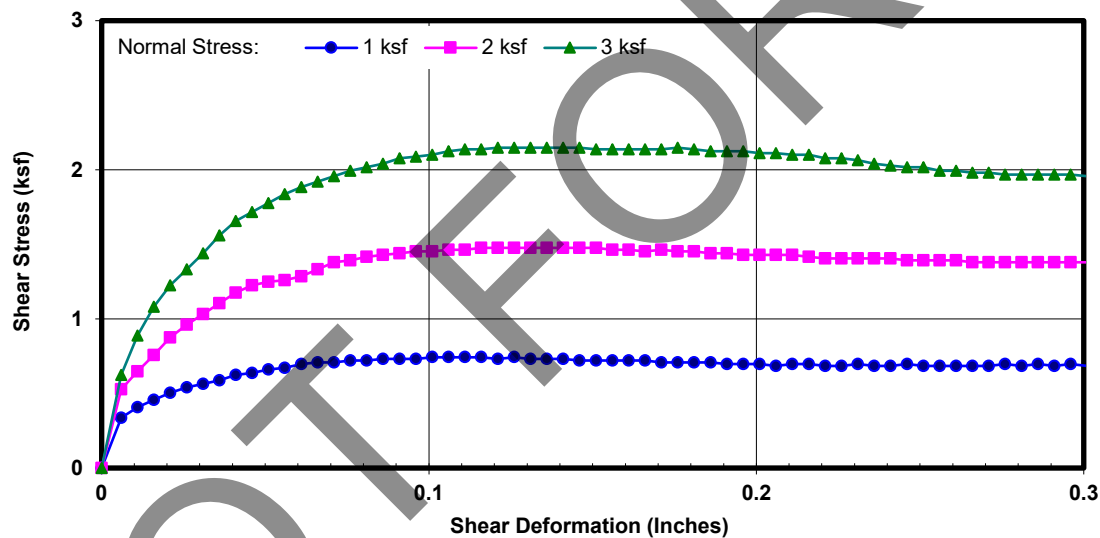


Figure No. B-7



DIRECT SHEAR TEST RESULTS ASTM D 3080

Project Name: STK - Fire Station 227
Project No.: 5163-193
Boring No.: B-03
Sample No.: - Depth (ft): 2.5-3.5
Sample Type: Mod. Cal.
Soil Description: Silty Sand
Test Condition: Inundated Shear Type: Regular

Tested By: ST Date: 08/02/24
Computed By: JP Date: 08/07/24
Checked by: AP Date: 08/07/24

Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Initial Degree Saturation (%)	Final Degree Saturation (%)	Normal Stress (ksf)	Peak Shear Stress (ksf)	Ultimate Shear Stress (ksf)
106.1	102.4	3.6	21.0	15	88	1	0.720	0.720
						2	1.344	1.308
						3	1.980	1.927

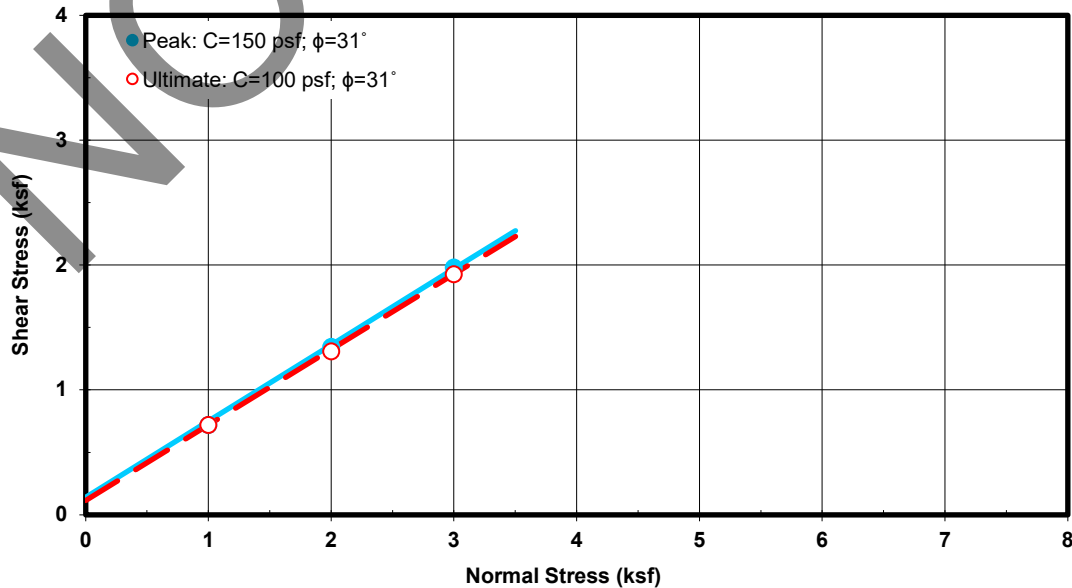
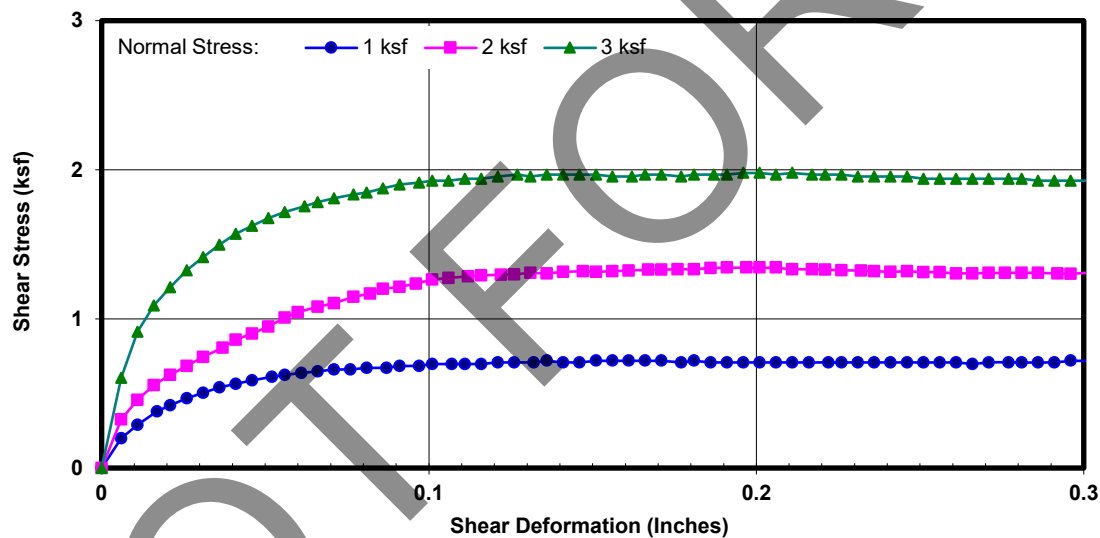


Figure No. B-8

**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com**CORROSION TEST RESULTS**Client Name: Inland Foundation EngineeringAP Job No.: 24-0764Project Name: STK - Fire Station 227Date: 08/01/24Project No.: 5163-193

Boring No.	Sample No.	Depth (feet)	Soil Description	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B-01	-	0-4.5	Silty Sand w/gravel	7,790	8.5	52	30

NOTES:

Resistivity Test and pH: California Test Method 643

Sulfate Content : California Test Method 417

Chloride Content : California Test Method 422

ND = Not Detectable

NA = Not Sufficient Sample

NR = Not Requested

Job No. CB191148
Date. 8/8/2024

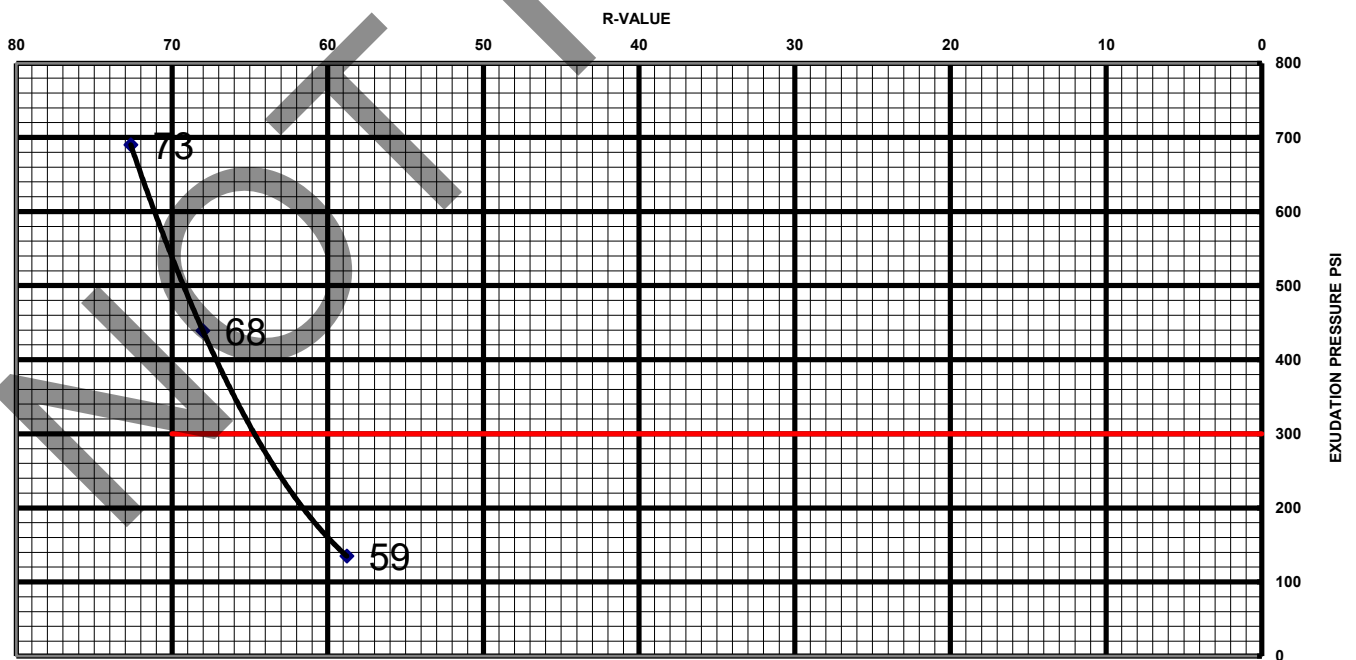
**LABORATORY RECORD OF TESTS MADE ON
BASE, SUBBASE, AND BASEMENT SOILS**

CLIENT: Inland Foundation Engineering
PROJECT STK-Fire Station 227 S168-193
LOCATION:
R-VALUE # : B-03
T.I. :

COMPACTOR AIR PRESSURE P.S.I.
INITIAL MOISTURE %
WATER ADDED, ML
WATER ADDED %
MOISTURE AT COMPACTION %
HEIGHT OF BRIQUETTE
WET WEIGHT OF BRIQUETTE
DENSITY LB. PER CU.FT.
STABILOMETER PH AT 1000 LBS.
2000 LBS.
DISPLACEMENT
R-VALUE
EXUDATION PRESSURE
THICK. INDICATED BY STAB.
EXPANSION PRESSURE
THICK. INDICATED BY E.P.

A	B	C	D
350	350	350	
3.7	3.7	3.7	
70	60	50	
6.6	5.6	4.7	
10.3	9.3	8.4	
2.48	2.50	2.50	
1106	1107	1106	
122.6	122.7	123.7	
23	18	16	
38	29	26	
5.63	5.31	4.85	
59	68	73	
135	439	690	
0.00	0.00	0.00	
0	0	0	
0.00	0.00	0.00	

EXUDATION CHART



R-Value: 64

NOT FOR BID

APPENDIX C

INFILTRATION TESTING

Infiltration testing was conducted in general accordance with Appendix D of the Technical Guidance Document for Water Quality Management Plans for the County of San Bernardino Areawide Stormwater Program (2013). The shallow percolation test method was used per the Riverside County Department of Environmental Health guidelines. The percolation rates were converted to infiltration rates using the Porchet method.

Four percolation tests were performed at the locations shown on Figure A-2. The test holes were drilled on July 11, 2024 to depths of approximately 4 and 5 feet below existing ground surface. The test holes were approximately eight (8) inches in diameter. Gravel was placed in the bottom of each test hole. The test holes were then pre-soaked by inverting 5-gallons of water above the test hole.

Testing was conducted 24 hours after the pre-soak on July 12, 2024. All pre-soak water had percolated through the test holes. For all tests, more than 6 inches of water seeped away twice consecutively in less than 25 minutes, which meets the sandy soil criteria. The tests were then run for an additional hour with measurements taken every 10 minutes.

The water percolated through all test holes within all 10-minute test intervals. The percolation rates were calculated to range from 1.0 to 2.5 minutes per inch (mpi). The percolation test rate was converted to an infiltration rate (I_c) using the Porchet method and the following equation:

$$I_c = \Delta H 60r / \Delta t (r + 2H_{avg})$$

Where:

r = Test Hole Radius (in.)

H_{avg} = Average Height of Water during Test Interval (in.)

ΔH = Change in Water Height during Test Interval (in.), and

Δt = Time Interval (in.)

The corresponding calculated infiltration rates (I_c) ranged from 2.0 to 5.7 inches per hour. These values exclude a factor of safety. Copies of the field test sheets are included with this report as Figures C-2 through C-5.

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-01				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 60"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	6:59	7:24	25	31	58	27	Y		
2	7:25	7:50	25	36	58	22	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div$ 2	I_T $\frac{\Delta H \ 60r}{\Delta t(r+2H)}$ Avg
1	7:51	8:01	10	36	51	15	.67	16.5	9.7
2	8:02	8:12	10	36	48.5	12.5	.80	17.8	7.6
3	8:13	8:23	10	36	47	11	.91	18.5	6.4
4	8:24	8:34	10	36	46	10	1.0	19	5.7
5	8:35	8:45	10	36	46	10	1.0	19	5.7
6	8:47	8:57	10	36	46	10	1.0	19	5.7
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Overcast (75°)									

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-02				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 48"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	7:03	7:28	25	24	46	22	Y		
2	7:29	7:54	25	24	45.5	21.5	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div 2$	I_T $\frac{\Delta H 60r}{\Delta t(r+2H)}$ Avg
1	8:59	9:09	10	24	36	12	.83	18	7.2
2	9:10	9:20	10	24	34.5	11.5	.87	18.8	6.0
3	9:20	9:30	10	24	34.5	11.5	.87	18.8	6.0
4	9:31	9:41	10	24	34	10	1.0	19	5.7
5	9:42	9:52	10	24	34	10	1.0	19	5.7
6	9:53	10:03	10	24	34	10	1.0	19	5.7
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Overcast (77°F)									

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-03				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 60"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	7:06	7:31	25	35	46	11	Y		
2	7:32	7:57	25	36	45	9	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div 2$	I_T $\frac{\Delta H 60r}{\Delta t(r+2H)}$ Avg
1	10:04	10:14	10	36	40	4	2.5	22	2.0
2	10:15	10:25	10	36	40	4	2.5	22	2.0
3	10:26	10:36	10	36	40	4	2.5	22	2.0
4	10:37	10:47	10	36	40	4	2.5	22	2.0
5	10:48	10:58	10	36	40	4	2.5	22	2.0
6	10:59	11:09	10	36	40	4	2.5	22	2.0
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Partly Cloudy (83°F)									

PERCOLATION TEST DATA SHEET – INFILTRATION TESTING

Project: Fire Station 227				Project No.: S168-193		Date: 7/12/2024			
Test Hole No.: P-04				Tested By: Floyd Collins					
Depth of Test Hole (D_T): 48"				USCS Soil Classification: SM					
Test Hole Dimensions (inches)				Length		Width			
Diameter (if round)= 8"		Sides (if rectangular) =							
Sandy Soil Criteria Test*									
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6" (Y/N)		
1	7:07	7:32	25	24	46	22	Y		
2	7:33	7:58	25	24	45	21	Y		
3									
*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".									
Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	$\Delta D = \Delta H$ Change in Water Level (in.)	Perc. Rate min./in.	H_{Avg} ($D_T - D_o$) + ($D_T - D_f$) $\div 2$	I_T $\frac{\Delta H 60r}{\Delta t(r+2H)}$ Avg
1	11:09	11:19	10	24	36	12	.83	18	7.2
2	11:20	11:30	10	24	35	11	.91	18.5	6.4
3	11:31	11:41	10	24	34.5	10.5	.95	18.8	6.0
4	11:42	11:52	10	24	34	10	1.0	19	5.7
5	11:53	12:03	10	24	34	10	1.0	19	5.7
6	12:04	12:14	10	24	34	10	1.0	19	5.7
7									
8									
9									
10									
11									
12									
13									
14									
15									
COMMENTS: Presoaked hole on 7/11/2024. Dry hole next day. First two measurements met sandy soil criteria. Partly cloudy (89°F)									

**APPENDIX D –
Liquefaction and Seismic
Settlement Analysis**

NOT FOR BID

APPENDIX D

LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSIS

Liquefaction and seismic settlement potential were evaluated using the GeoSuite® computer program (version 3.2.1.6). The seismic parameters included a horizontal acceleration of 0.95g and a Moment Magnitude of 8.1. We analyzed the soil profile logged for exploratory boring B-02. The GeoSuite® program calculates corrected normalized SPT N-values $(N_1)_{60}$ using the following formula (SCEC, 1999).

$$(N_1)_{60} = N_M C_N C_E C_B C_R C_S$$

Where; N_M = measured standard penetration resistance. Modified California sample blowcounts were converted to SPT blowcounts using Burmister's formula (1948) prior to input in the program. The modified California sample blowcounts were also corrected to account for lined samplers, as described in the C_S factor discussion below.

C_N = depth correction factor. GeoSuite® calculates C_N for each layer in the soil profile using the relationship suggested by Idriss and Boulanger (2008)

C_E = hammer energy ratio (ER) correction factor. A C_E factor of 1.3 was applied for the automatic trip hammer used during drilling and was calculated using the relationship suggested by Idriss and Boulanger (2008).

C_B = borehole diameter correction factor. A C_B factor of 1.0 was applied for the 8-inch diameter hollow-stem augers with inside diameters of four (4) inches (SCEC 1999).

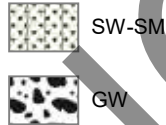
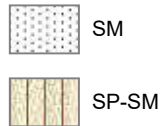
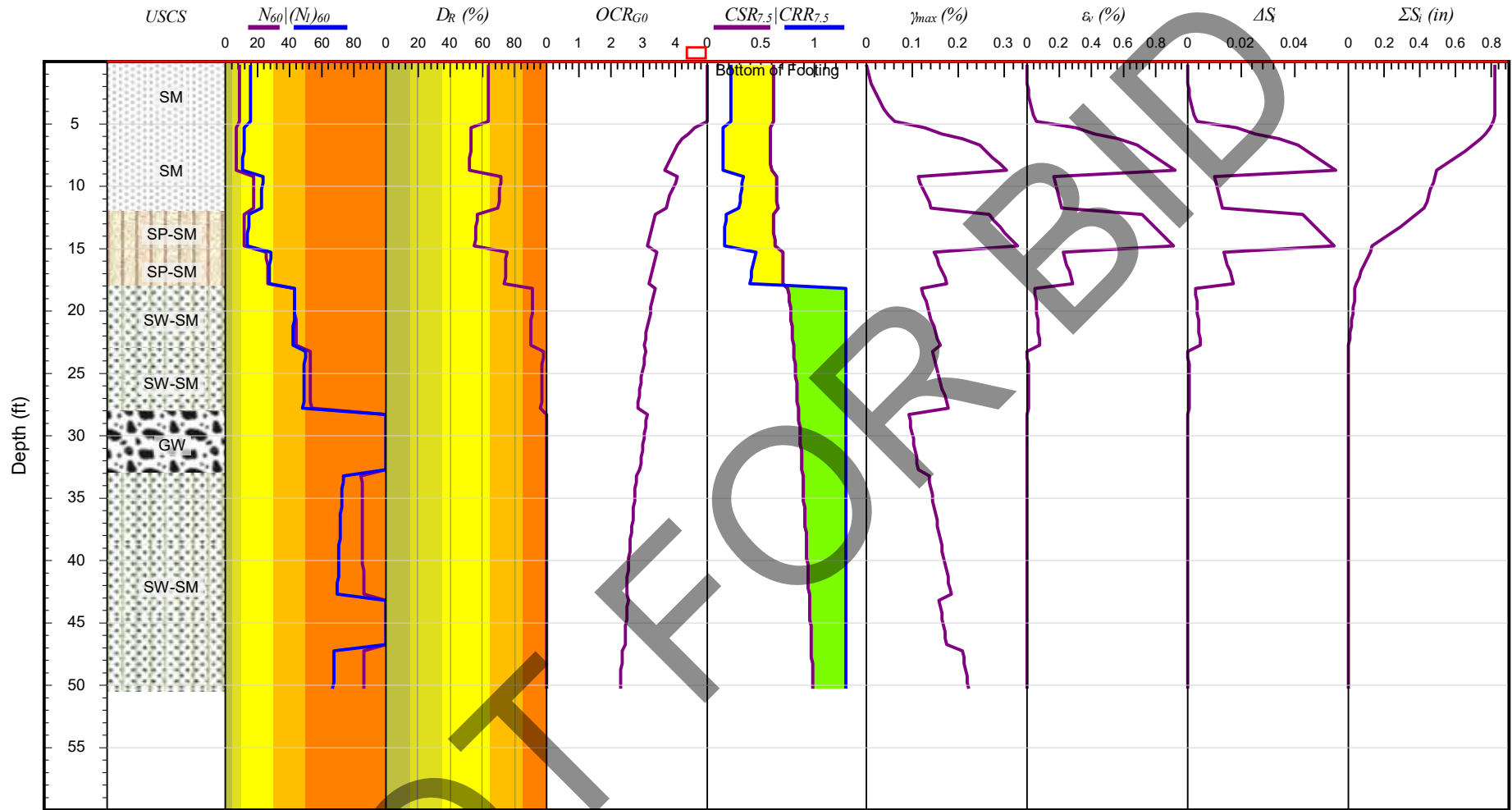
C_R = rod length correction factor. GeoSuite® applies a C_R factor for each layer in the soil profile using the values in Table 5.2 of the 1999 SCEC guidelines, and assuming a rod stick up length (above the ground surface) of 3 feet.

C_S = correction factor for samplers with or without liners. SPT samplers without liners were used for this project. For SPT samplers without liners, GeoSuite® applies a C_S factor for each layer in the soil profile using the relationships from Seed et al. (1984) and suggested by Idriss and Boulanger (2008). Since GeoSuite® applies a C_S factor to all layers in the soil profile, it is necessary to adjust blowcounts for modified California samplers with liners.

This was done through an iterative process by initially dividing the modified California sampler blowcounts by an assumed C_S value of 1.2 prior to input in the program.

Calculated C_S values were then checked against the assumed values and adjusted where necessary, so that the actual applied C_S value for modified California samples is 1.0.

The results of the analysis are shown on Figure D-2.



Silt Correction:
UCLA method

Earthquake & Groundwater Information:
Magnitude = 8.1
Max. Acceleration = 0.95 g
Project GW = 100 ft
Maximum Settlement = 0.82 in
Settl. at Bottom of Footing = 0.82 in

Liquefaction: Boulanger & Idriss (2010-16)
Settl.: [dry] Yi (2022)
Lateral spreading: Idriss & Boulanger (2008)
M correction: [Sand] Boulanger & Idriss (2004)
 σ_v correction: Idriss & Boulanger (2008)
Stress reduction: Idriss & Boulanger (2008)

IFE

Seismic Settlement Potential - SPT Data

Project:	Fire Station 227				
Location:	Genevieve and 38th				
Project No.:	S168-193	Boring No.:	B-02	Figure: D-2	0

NOT FOR BID



GEOLOGIC HAZARDS REPORT
SAN BERNARDINO COUNTY FIRE STATION 227
NWC OF 38TH STREET AND GENEVIEVE AVENUE
CITY OF SAN BERNARDINO, CALIFORNIA

Project No. 244073-1

July 20, 2024

Prepared for:

Inland Foundation Engineering, Inc.
1310 South Santa Fe Avenue
San Jacinto, CA 92583

Inland Foundation Engineering, Inc.
1310 South Santa Fe Avenue
San Jacinto, CA 92583

Attention: Mr. Allen Evans, P.E., G.E., Principal

Regarding: Geologic Hazards Report
San Bernardino County Fire Station 227
NWC of 38th Street and Genevieve Avenue
City of San Bernardino, California
IFE Project No. S168-193

At your request, this firm has prepared a geologic hazards report for the proposed new San Bernardino County Fire Station 227, as referenced above. The purpose of this study was to evaluate the existing geologic conditions of the property and any corresponding potential geologic and/or seismic hazards, with respect to the proposed development from a geologic standpoint. This report has been prepared utilizing the suggested "Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings" (CGS Note 48, 2022).

The scope of services provided for this evaluation included the following:

- **Review of available published and unpublished geologic/seismic data in our files pertinent to the site, including the provided site-specific boring logs.**
- **Performing a seismic surface-wave survey by a licensed State of California Professional Geophysicist that included one traverse for shear-wave velocity analysis purposes.**
- **Evaluation of the local and regional tectonic setting and historical seismic activity, including performing a site-specific CBC ground motion analysis.**
- **Preparation of this report presenting our findings, conclusions, and recommendations from a geologic standpoint.**

Accompanying Maps and Appendices

- Plate 1 - Regional Geologic Map
- Plate 2 - Google™ Earth Imagery Map
- Plate 3 - Site Plan
- Appendix A - Shear-Wave Survey
- Appendix B - Site-Specific Ground Motion Analysis
- Appendix C - References

PROJECT SUMMARY

We understand that this report will be appended to your current geotechnical investigation, therefore, some descriptive sections such as site description, proposed development, etc., have been purposely omitted as they have been described in detail in your referenced report. No grading plans were available for this evaluation, and no field or subsurface exploration was performed by this firm. Only a review of available geologic and geotechnical data in our files was undertaken, including observation of the exploratory borings that were drilled by Inland Foundation engineering, Inc. (IFE) on July 11, 2024, including performing a seismic shear-wave survey.

GEOLOGIC SETTING

The subject site lies within a natural geomorphic province in California known as the Peninsular Ranges. This province is characterized by northwest-trending valleys and mountains that are, in part, due to the tectonic framework of this area, which is also dominated by a northwest-trending structure. Locally, the study area is included within a sub-structural unit of the Peninsular Ranges known as the San Bernardino Valley Block. This block is essentially a depressed region bounded by faults to the northeast (San Andreas), the southwest (San Jacinto), and the south (Banning).

The San Bernardino Valley is formed by a series of coalescing alluvial fans, of which the combined fan of the Santa Ana River and Mill Creek, originating from to the northeast, is the largest and most distinct. This and other alluvial fans (i.e., Lytle and Cajon Creeks, Devil Canyon, East Twin and City Creeks) emanate the mountains, then coalesce to form part of a broad alluvial plain, which then forms the San Bernardino Valley.

The subject area investigated for this report is included within the flood/alluvial plain limits of the San Bernardino Valley, situated near the eastern flank of Little Mountain, which is a low-lying bedrock hill that locally protrudes from the San Bernardino Valley. Geologic mapping of the area by Miller et al. (2001), as illustrated on Plate 1, indicates that the project development area is locally underlain by both slightly- to moderately consolidated early Holocene and late Pleistocene alluvial fan deposits (map symbol Qyf₁), generally described as sand and pebble-boulder gravel, along with late Holocene age very young wash deposits (map symbol Qw), consisting of unconsolidated to locally cemented sand, gravel, and boulder deposits. Relatively older and more consolidated alluvial deposits are presumed to underlie the subject site at depth.

The exploratory boring logs prepared by IFE (2024) indicate that the subject site is underlain predominantly by interbedded fine- to medium-grained silty sand, fine- to coarse-grained sand with silt, fine- to coarse-grained sand, and gravel with fine- to coarse-grained sand, along with gravel and cobbles throughout. These alluvial deposits were noted to be in a generally loose to very dense condition, to a depth of at least 50½ feet locally.

FAULTING

There are at least forty-three major late Quaternary active/potentially active faults that are located within a 100-kilometer (62-mile) radius of the subject site (Blake, 1989-2000). Of these, there are no known active faults that traverse the site based on available published literature, nor was there any surficial geomorphic evidence that was suggestive of faulting. Additionally, the subject site is not located within a State of California "Alquist-Priolo Earthquake Fault Zone" for surface-fault rupture hazard (California Division of Mines and Geology, 1974).

The nearest known "active" fault that is zoned by the California Geological Survey is the San Andreas Fault (San Bernardino North Segment), located approximately $1.1 \pm$ miles to the northeast (C.D.M.G., 1974), as shown on the Regional Geologic Map, Plate 1, for reference. This fault segment is a right-lateral, strike-slip fault, being approximately 103-kilometers in length, with an associated maximum moment magnitude (M_w) of 7.4 and a slip-rate of 24 ± 6 mm/year (C.D.M.G., 1996, Cao, et al., 2003, and Petersen et al., 2008).

However, for seismic design purposes, we are considering that a cascading effect of rupture will occur along the entire length of the southern San Andreas Fault Zone (which includes ten segments, collectively) rather than just the San Bernardino North segment. Based on the recently published rupture-model data (Petersen et al., 2008), the total rupture area of these combined faults is 6,849.7 square kilometers and has an associated Maximum Moment Magnitude (M_w) of 8.1.

GROUND MOTION ANALYSIS

According to California Geological Survey Note 48 (CGS, 2022), a site-specific ground motion analysis is required for the subject site (CBC, 2022, Section 1613A and also as required by ASCE 7-16, Chapter 21). The results of this analysis are presented within Appendix B for documentation purposes. Additionally, a seismic shear-wave survey was conducted for this study by our firm as presented within Appendix A of this report for purposes of determining the soil Site Classification and V_{s30} input values for the ground motion analysis. This survey was performed within the limits of the proposed construction.

Geographically, the subject construction area is centrally located at Latitude 34.1601 and Longitude -117.2866 and (World Geodetic System of 1984 coordinates). The mapped spectral acceleration parameters, coefficients, and other related seismic parameters, were evaluated using the California's Office of Statewide Health Planning and Development Seismic Design Maps (OSHPD, 2024) and the California Building Code criteria (CBC, 2022), with the site-specific ground motion analysis being performed following Section 21 of the ASCE 7-16 Standard (2017). The results of this site-specific analysis have been summarized and are tabulated below:

TABLE 1 – SUMMARY OF SEISMIC DESIGN PARAMETERS

Factor or Coefficient	Value
S_s	2.506g
S₁	1.002g
F_a	1.2
F_v	1.7
S_{DS}	1.670g
S_{D1}	1.620g
S_{MS}	2.506g
S_{M1}	2.429g
T_L	8 Seconds
MCEG PGA	0.95g
Shear-Wave Velocity (V₁₀₀)	1,075.1 ft/sec
Site Classification	D
Risk Category	IV

HISTORIC SEISMICITY

A computerized search, based on Southern California historical earthquake catalogs, has been performed using the computer program EQSEARCH (Blake, 1989-2021) and the ANSS Comprehensive Earthquake Catalog (U.S.G.S., 2024a). The following table and discussion summarizes the historic seismic events (greater than or equal to M4.0) that have been estimated and/or recorded during the time period of 1800 to July 2024, within a 100-kilometer radius of the site.

TABLE 2 - HISTORIC SEISMIC EVENTS; 1800-2024 (100-kilometer radius)

<u>Richter Magnitude (M)</u>	<u>No. of Events</u>
4.0 - 4.9	628
5.0 - 5.9	73
6.0 - 6.9	15
7.0 - 7.9	1
8.0+	0

It should be noted that pre-instrumental seismic events (generally before 1932) have been estimated from isoseismal maps (Toppozada, et al., 1981 and 1982). These data have been compiled generally based on the reported intensities throughout the region, thus focusing in on the most likely epicentral location. Instrumentation beyond 1932 has greatly increased the accuracy of locating earthquake epicenters. A summary of the historic earthquake data is as follows:

- ❑ The closest recorded notable earthquake epicenter (magnitude 4.0 or greater) is a M4.2 event (June 28, 1997), which occurred approximately three miles to the west-northwest.
- ❑ The nearest estimated significant historic earthquake epicenter (pre-1932) was approximately 4± miles southwest of the site (July 15, 1905, M5.3).
- ❑ The nearest recorded significant historic earthquake epicenter was a M5.6 event of October 16, 1999, located approximately 15 miles northeast of the site.
- ❑ The largest estimated historical earthquake epicenter (pre-1932) within a 62-mile radius of the site is a M6.9 event of December 8, 1812 (25± miles northwest).
- ❑ The largest recorded historical earthquake was the M7.6 Landers's event, located approximately 49 miles to the east (June 28, 1992).
- ❑ The largest estimated ground acceleration estimated to have been experienced at the site was at least 0.215g which resulted from the M5.3 event of July 15, 1905, located approximately 4± miles to the southwest (Blake, 1989-2000b) based on the attenuation relationship of Boore et al. (1997).

An Earthquake Epicenter Map which includes magnitudes 4.0 and greater for a 100-kilometer (62-mile) radius (blue circle) from the site (central blue dot), has been included below as Figure 1. This map was prepared using the ANSS Comprehensive Earthquake Catalog (U.S.G.S, 2024a) of instrumentally recorded events from the period of 1932 to July 2024.

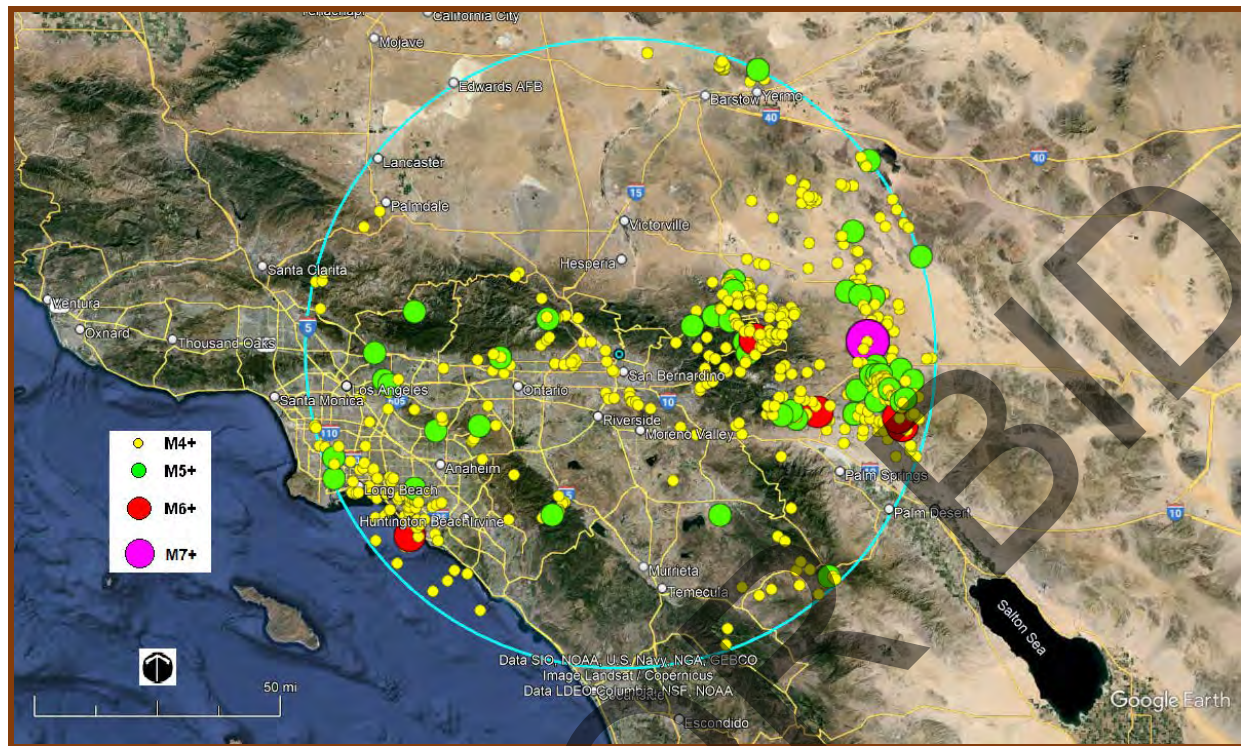


FIGURE 1- Earthquake Epicenter Map showing events of M4.0+ within a 100-kilometer radius.

GROUNDWATER

The subject site is located within the Bunker Hill Basin, which is a subunit of the greater Upper Santa Ana Valley Groundwater Basin in Southern California. This basin is bordered on the west by the San Jacinto Fault, the northeast by the San Bernardino Mountains, the south by the Badlands, and east by Crafton Hills. The area of the basin is approximately 110 square miles. The water-bearing material in the basin consists of alluvial deposits of sand, gravel, and boulders interspersed with lenticular deposits of silt and clay. In the Bunker Hill Basin, most of the recharge to groundwater is supplied by runoff from the San Bernardino Mountains, and smaller amounts by deep penetration of rainfall and artificial recharge. Within the Bunker Hill Basin, groundwater generally flows similar to that of surface draining. Locally, groundwater flows toward the southwest (Duell and Schroeder, 1989).

Based on groundwater data provided by the California Department of Water Resources (2024b), the closest measured well was located $1,900 \pm$ feet southeast of the site (State Well No. 01N04W22J001S), which indicates that groundwater had ranged from a depth of 124 to $154 \pm$ feet between the time period of 1940 to 1944. Groundwater data prepared by Matti and Carson (1991) indicates that high groundwater was estimated to be around $150 \pm$ feet in depth based on contour data. During the recent subsurface investigation performed by IFE (2024), groundwater was not encountered within any of the exploratory borings excavated at the site to a depth of at least $50\frac{1}{2}$ feet.

SECONDARY SEISMIC HAZARDS

Secondary permanent or transient seismic hazards that are generally associated with severe ground shaking during an earthquake include ground rupture, liquefaction, seiches or tsunamis, flooding (water storage facility failure), ground lurching/lateral spreading, landsliding, rockfalls, and seismically-induced settlement. These hazards are discussed below.

Ground Rupture- Ground rupture is generally considered most likely to occur along pre-existing faults. Since no known active faults are believed to traverse the subject site, the probability of ground rupture is considered very low to nil.

Ground Lurching/Lateral Spreading- Ground lurching is the horizontal movement of soil, sediments, or fill located on relatively steep embankments or scarps as a result of seismic activity, forming irregular ground surface cracks. The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground. Due to the flat-lying nature of the site, distance from embankments, the potential for ground lurching and/or lateral spreading is nil.

Seismically-Induced Settlement- Seismically-induced settlement generally occurs within areas of loose granular soils. The proposed construction area is locally underlain by interbedded fine- to medium-grained silty sand, fine- to coarse-grained sand with silt, fine- to coarse-grained sand, and gravel with fine- to coarse-grained sand, with gravel and cobbles throughout. Locally, portions of the upper 8± feet of the surface were noted to be in a loose condition, directly underlain by medium dense to very dense sediments, to a depth of at least 50½ feet. Therefore, there appears to be at least a low potential for seismically-induced settlement to occur.

Landsliding- Due to the relatively low-lying relief of the site, landsliding of the site due to seismic shaking is considered nil. According to the City of San Bernardino Slope Stability and Major Landslides Map (2005, Figure S-7), the site is not shown to be within the limits of generalized landslide susceptibility.

Liquefaction- In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soils from repeated disturbances of saturated cohesionless soil that can result in the settlement of buildings, ground failures, or other such related hazards. The main factors generally contributing to this phenomenon are: 1) cohesionless, granular soils having relatively low densities (usually of Holocene age); 2) shallow groundwater (generally less than 40 feet); and 3) moderate-high seismic ground shaking. According to the City of San Bernardino Liquefaction Susceptibility Map (2005, Figure S-5), the subject site is not shown to be located within the limits of a liquefaction zone. Due to the greater than 50-foot depth to groundwater, dense nature of the alluvial deposits at depth, there does not appear to be a potential for liquefaction to occur.

Flooding (Water Storage Facility Failure)- Based on the data prepared by the California Department of Water Resources (2024a), the subject site is shown to be located within the limits of flood inundation in the event of catastrophic failure of the Little Mountain Dam, which is located approximately 2,700± feet to the northwest, as generally indicated on Figure 2 below (site outlined in red). Therefore, the potential for flooding due to water storage facility failure is considered possible. There are no other water-storage facilities that are topographically higher than that of the subject site, which could cause flooding due to catastrophic failure.

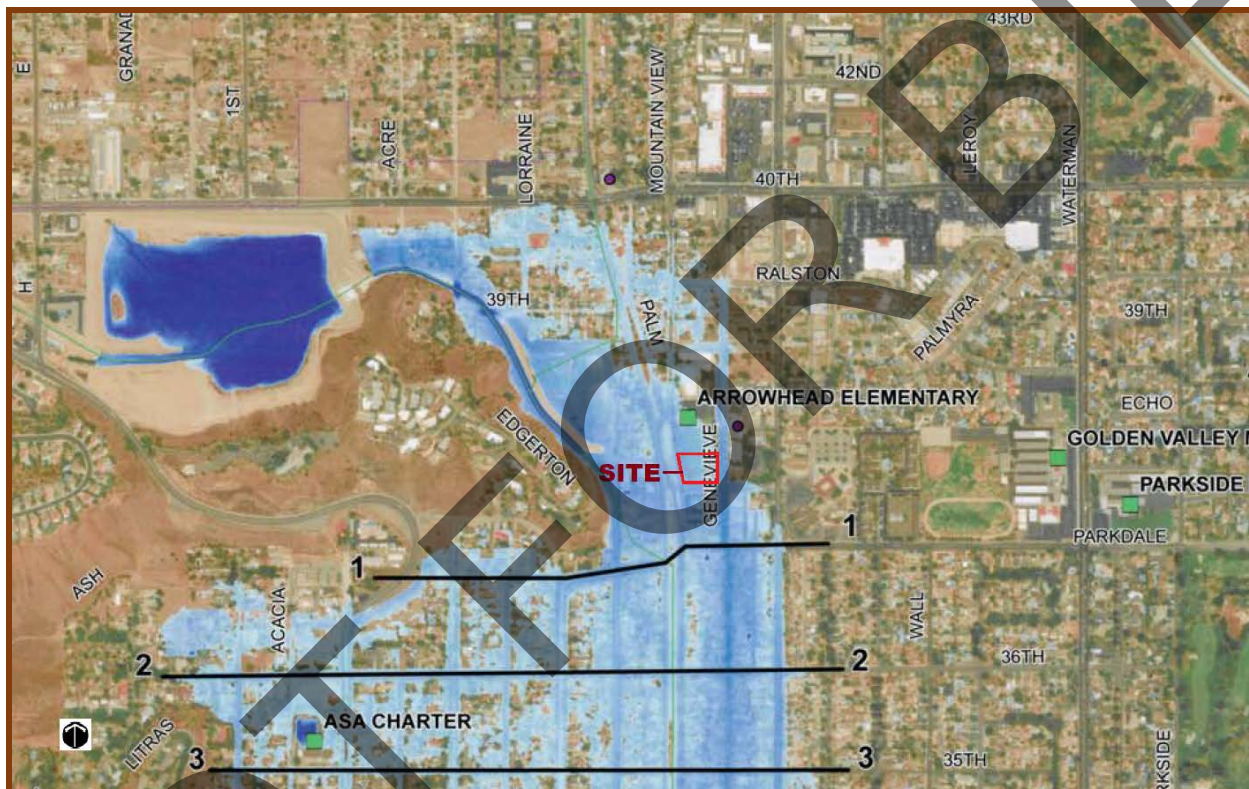


FIGURE 2- Dam Inundation Map (San Bernardino County, 2018); flooding shown as blue shading.

Seiches/Tsunamis-

Based on the far distance of large, open bodies of water and the elevation of the site with respect to sea level, the possibility of seiches/tsunamis is considered nil. Additionally, mapping by the California Geological Survey (2014) does not indicate the site to be located within a tsunami inundation zone.

Rockfalls-

The subject site lies upon a relatively flat-lying alluvial plain. Since no large rock outcrops are present at or adjacent to the site, the possibility of rockfalls during seismic shaking is nil.

FLOODING

According to the Federal Emergency Management Agency (FEMA), the subject site is not located within the boundaries of a 100-year flood (Community Panel No. 06071C 7945H, September 26, 2008). The site is shown to be located within “Other Flood Areas - Zone X,” which is defined as “Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.” A portion of the FEMA Flood Zone Map is shown below in Figure 2 for reference.

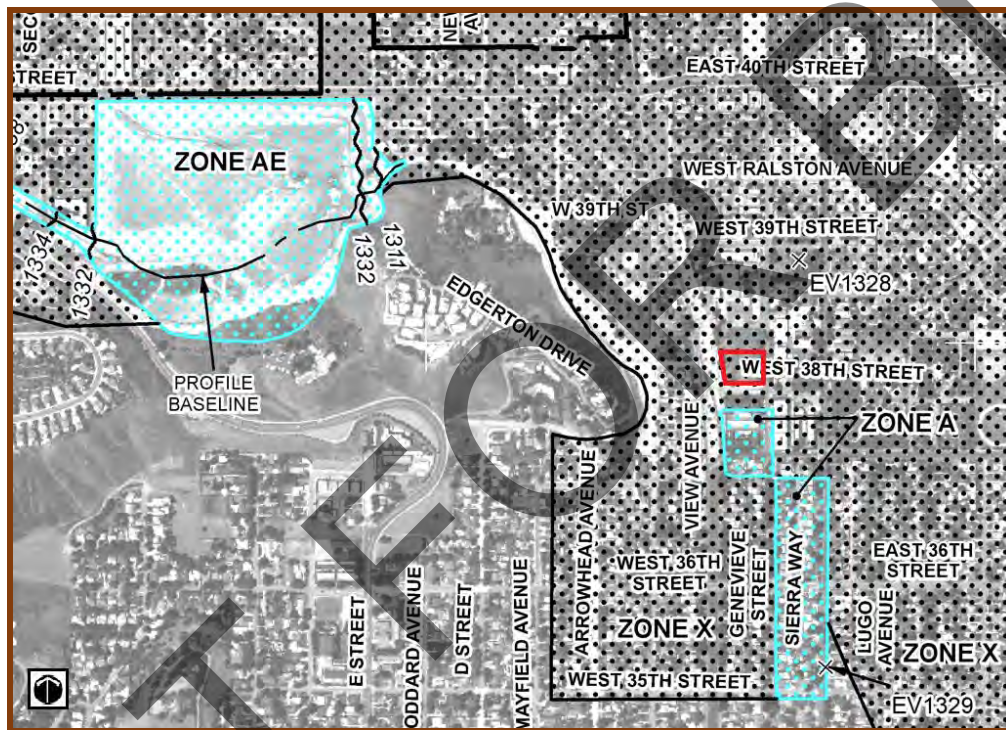


FIGURE 2- FEMA Flood Zone Map; Site boundary approximated by red outline.

GROUND SUBSIDENCE

Ground subsidence can be caused by natural geologic processes or by human activity such as groundwater and/or oil withdrawal and subsurface mining. Historic ground subsidence within the City of San Bernardino was generally located within the thick, poorly consolidated alluvial and marsh deposits of an old artesian area north of Loma Linda. Beginning in 1972, the San Bernardino Municipal Water District has maintained groundwater levels from recharge to percolation basins that, in turn, filter back into the alluvial deposits. Since the groundwater recharge program began, problems with ground subsidence in the valley have not been identified. According to the City of San Bernardino Potential Subsidence Areas Map (2005, Figure S-6), the subject site is not shown to be located within the limits of “Areas of Potential Ground Subsidence”.

OTHER GEOLOGIC HAZARDS

There are other potential geologic hazards not necessarily associated with seismic activity that occur statewide. These hazards include; natural hazardous materials (such as methane gas, hydrogen-sulfide gas, and tar seeps); Radon-222 gas (EPA, 1993); naturally occurring asbestos; volcanic hazards (Martin, 1982); and regional subsidence. Of these hazards, there are none that appear to impact the site.

CONCLUSIONS AND RECOMMENDATIONS

General:

Based on our review of available pertinent published and unpublished geologic/seismic literature, construction of the proposed new fire station facility appears to be feasible from a geologic standpoint, providing our recommendations are considered during planning and construction.

Conclusions:

1. Based on available published geologic data, the subject site is underlain by both slightly- to moderately consolidated early Holocene and late Pleistocene alluvial fan deposits, generally described as sand and pebble-boulder gravel, along with late Holocene age very young wash deposits, consisting of unconsolidated to locally cemented sand, gravel, and boulder deposits. Site-specific exploration performed by IFE indicates the site to be underlain by interbedded fine- to medium-grained silty sand, fine- to coarse-grained sand with silt, fine- to coarse-grained sand, and gravel with fine- to coarse-grained sand, with gravel and cobbles throughout. Locally, portions of the upper 8± feet of the surface were noted to be in a loose condition, directly underlain by medium dense to very dense sediments, to a depth of at least 50½ feet.
2. Groundwater was not encountered within the exploratory excavations performed by IFE to a depth of at least 50½ feet. Nearby historic and current groundwater data indicate that groundwater may have been as high as 125± feet in depth, locally. No shallow groundwater conditions are anticipated to be encountered during construction.
3. Based on our literature research, there are no active faults that are known to traverse the subject site. The nearest zoned active fault is associated with the active San Andreas Fault (North Branch) located approximately 1.1± miles to the northeast.
4. The primary geologic hazard that exists at the site is that of ground shaking, which accounts for nearly all earthquake losses. Moderate to severe ground shaking could be anticipated during the life of the proposed development.

5. Due to the nature of the surficial underlying unconsolidated sediments, there may be a potential for secondary seismic settlement to occur. Additionally, the site lies within the inundation limits in the event of catastrophic failure of the Little Mountain Dam, located approximately 2,700± feet to the northwest. No other permanent and/or transient secondary seismic hazards are expected to occur within the proposed construction area.

Recommendations:

1. The potential for seismically-induced settlement should be properly evaluated by the project Geotechnical Engineer. Appropriate site-specific mitigation measures, should be implemented as recommended, if warranted.
2. The potential for flooding due to catastrophic failure of Little Mountain Dam should be properly evaluated by the project Civil Engineer or other appropriate design professional. Appropriate site-specific mitigation measures, should be implemented as recommended, if warranted.
3. It is recommended that all structures be designed to at least meet the current California Building Code provisions in the latest 2022 CBC edition and the 2016 ASCE Standard 7-16, where applicable. However, it should be noted that the building code is intended as a minimum construction design and is often the maximum level to which structures are designed. Structures that are built to minimum code are designed to at least remain operational after an earthquake. It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the proposed facilities. When considering that a cascading rupture event could occur along the entire length of the San Andreas Fault Zone (which includes all segments), the resulting maximum moment magnitude earthquake is estimated to be Mw8.1, which should be used for seismic design purposes.

CLOSURE

Our conclusions and recommendations are based on a review of available existing published geologic/seismic data and the provided site-specific subsurface exploratory boring logs. No subsurface exploration was performed by this firm for this evaluation. We make no warranty, either express or implied. Should conditions be encountered at a later date or more information becomes available that appear to be different than those indicated in this report, we reserve the right to reevaluate our conclusions and recommendations and provide appropriate mitigation measures, if warranted. It is assumed that all the conclusions and recommendations outlined in this report are understood and followed.

If any portion of this report is not understood, it is the responsibility of the owner, contractor, engineer, and/or governmental agency, etc., to contact this office for further clarification.

Respectfully submitted,
TERRA GEOSCIENCES

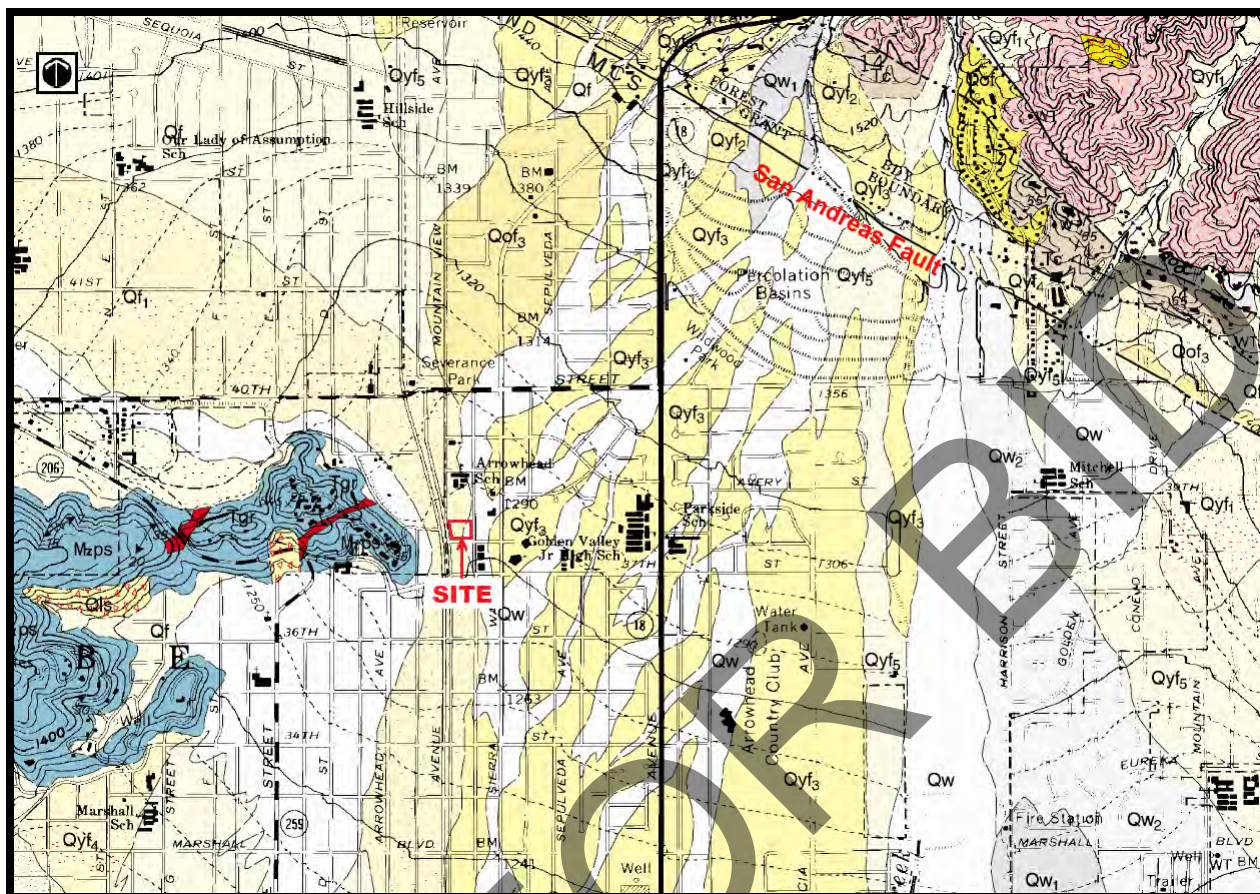


Donn C. Schwartzkopf
Principal Geologist / Geophysicist
CEG 1459 / PGP 1002



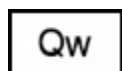
NOT FOR

REGIONAL GEOLOGIC MAP



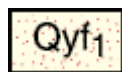
BASE MAP: Miller et al. (2001), U.S.G.S., Open File Report 01-131, Scale 1: 24,000, Site outlined in red.

PARTIAL LEGEND



YOUNG WASH DEPOSITS

Unconsolidated to locally cemented sand, gravel and boulders (late Holocene).



YOUNG FAN DEPOSITS

Slightly- to moderately-consolidated sand and pebble-boulder gravel (early Holocene and late Pleistocene).



PELONA SCHIST

Muscovite-chlorite-albite-quartz schist, fine-grained (Mesozoic).



GEOLOGIC CONTACT

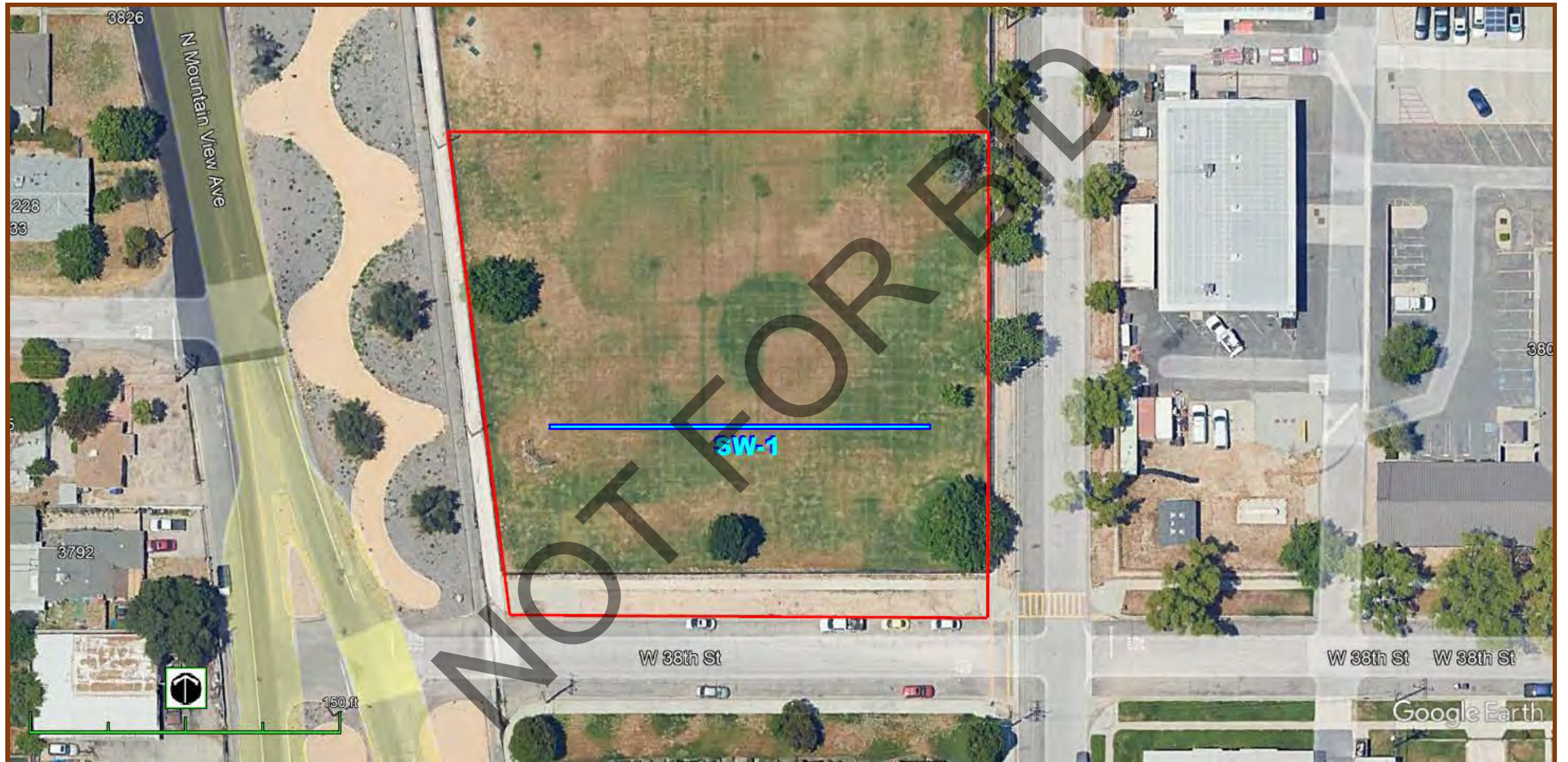
Solid where located within 15± meters; dashed where located within 30± meters.



FAULT

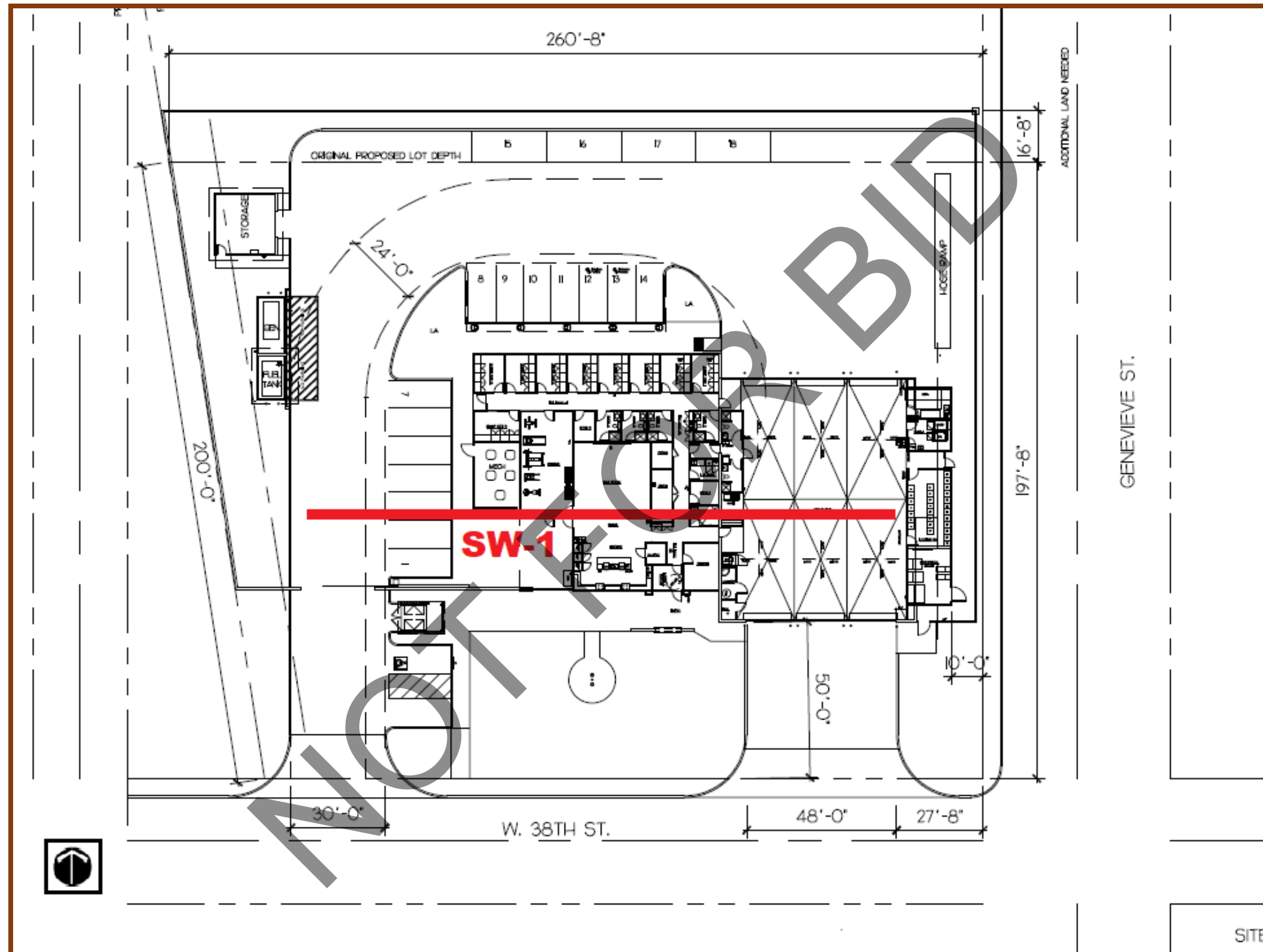
Solid where located within 15± meters; dashed where located within 30± meters; dotted where concealed.

GOOGLE™ EARTH IMAGERY MAP



Base Map: Captured Google™ Earth (2024); Seismic shear-wave traverse **SW-1** shown as blue line, approximate site boundary outlined in red.

SITE PLAN



BASE MAP: Provided "FS 227 Conceptual Site Plan" (Sheet A0.1, dated 6/12/24); prepared by STK Architecture, Inc., Temecula, California.

APPENDIX A

SHEAR-WAVE SURVEY

NOT FOR BIDD



SHEAR-WAVE SURVEY

Methodology

The fundamental premise of this survey uses the fact that the Earth is always in motion at various seismic frequencies. These relatively constant vibrations of the Earth's surface are called microtremors, which are very small with respect to amplitude and are generally referred to as background "noise" that contain abundant surface waves. These microtremors are caused by both human activity (i.e., cultural noise, traffic, factories, etc.) and natural phenomenon (i.e., wind, wave motion, rain, atmospheric pressure, etc.) which have now become regarded as useful signal information. Although these signals are generally very weak, the recording, amplification, and processing of these surface waves has greatly improved by the use of technologically improved seismic recording instrumentation and recently developed computer software. For this application, we are mainly concerned with the Rayleigh wave portion of the seismic signals, which is also referred to as "ground roll" since the Rayleigh wave is the dominant component of ground roll.

For the purposes of this study, there are two ways that the surface waves were recorded, one being "active" and the other being "passive." Active means that seismic energy is intentionally generated at a specific location relative to the survey spread and recording begins when the source energy is imparted into the ground (i.e., MASW survey technique). Passive surveying, also called "microtremor surveying," is where the seismograph records ambient background vibrations (i.e., MAM survey technique), with the ideal vibration sources being at a constant level. Longer wavelength surface waves (longer-period and lower-frequency) travel deeper and thus contain more information about deeper velocity structure and are generally obtained with passive survey information. Shorter wavelength (shorter-period and higher-frequency) surface waves travel shallower and thus contain more information about shallower velocity structure and are generally collected with the use of active sources.

For the most part, higher frequency active source surface waves will resolve the shallower velocity structure and lower frequency passive source surface waves will better resolve the deeper velocity structure. Therefore, the combination of both of these surveying techniques provides a more accurate depiction of the subsurface velocity structure.

The assemblage of the data that is gathered from these surface wave surveys results in development of a dispersion curve. Dispersion, or the change in phase velocity of the seismic waves with frequency, is the fundamental property utilized in the analysis of surface wave methods. The fundamental assumption of these survey methods is that the signal wavefront is planar, stable, and isotropic (coming from all directions) making it independent of source locations and for analytical purposes uses the spatial autocorrelation method (SPAC). The SPAC method is based on theories that are able to detect "signals" from background "noise" (Okada, 2003). The shear wave velocity (V_s) can then be calculated by mathematical inversion of the dispersive phase velocity of the surface waves which can be significant in the presence of velocity layering, which is common in the near-surface environment.

Field Procedures

One shear-wave survey traverse (SW-1) was performed within proposed construction area, as approximated on Plates 1 and 2. For data collection, the field survey employed a twenty-four channel Geometrics StrataVisor™ NZXP model signal-enhancement refraction seismograph. This survey employed both active source (MASW) and passive (MAM) methods to ensure that both quality shallow and deeper shear-wave velocity information was recorded (Park et al., 2005).

Both the MASW and MAM survey lines used the same linear geometry array that consisted of a 184-foot-long spread using a series of twenty-four 4.5-Hz geophones that were spaced at regular eight-foot intervals. For the active source MASW survey, the ground vibrations were recorded using a one second record length at a sampling rate of 0.5-milliseconds. Two separate seismic records were obtained using a 30-foot shot offset at both ends of the line utilizing a 16-pound sledge-hammer as the energy source to produce the seismic waves. Numerous seismic impacts were used at each shot location to improve the signal-to-noise ratio.

The MAM survey did not require the introduction of any artificial seismic sources with only background ambient noise (i.e., air and vehicle traffic, etc.) being necessary. These ambient ground vibrations were recorded using a thirty-two second record length at a two-millisecond sampling rate with 21 separate seismic records being obtained for quality control purposes. The frequency spectrum data that was displayed on the seismograph screen were used to assess the recorded seismic wave data for quality control purposes in the field. The acceptable records were digitally recorded on the in-board seismograph computer and subsequently transferred to a flash drive so that they could be subsequently transferred to our office computer for analysis.

Data Reduction

For analysis and presentation of the shear-wave profile and supportive illustration, this study used the **SeisImager/SW™** computer software program that was developed by Geometrics, Inc. (2021). Both the active (MASW) and passive (MAM) survey results were combined for this analysis (Park et al., 2005). The combined results maximize the resolution and overall depth range in order to obtain one high resolution V_s curve over the entire sampled depth range. These methods economically and efficiently estimate one-dimensional subsurface shear-wave velocities using data collected from standard primary-wave (P-wave) refraction surveys.

However, it should be noted that surface waves by their physical nature cannot resolve relatively abrupt or small-scale velocity anomalies and this model should be considered as an approximation. Processing of the data then proceeded by calculating the dispersion curve from the input data from both the active and passive data records, which were subsequently combined creating an initial shear-wave (V_s) model based on the observed data. This initial model was then inverted in order to converge on the best fit of the initial model and the observed data, creating the final V_s curve as presented within this appendix.

Summary of Data Analysis

Data acquisition went very smoothly and the quality was considered to be good. Analysis revealed that the average shear-wave velocity (“weighted average”) in the upper 100 feet of the subject survey area is **1,075.1** feet per second (327.7 meters/second) as shown on the shear-wave model for Seismic Line SW-1, as presented within this appendix. This average velocity classifies the underlying soils to that of Site Class “**D**” (“Stiff Soil” profile), which has a velocity range from 600 to 1,200 ft/sec (ASCE, 2017; Table 20.3-1).

The “weighted average” velocity is computed from a formula that is used by the ASCE (2017; Section 20.4, Equation 20.4-1) to determine the average shear-wave velocity for the upper 100 feet of the subsurface (V_{100}).

$$V_s = 100 / [(d_1/v_1) + (d_2/v_2) + \dots + (d_n/v_n)]$$

Where $d_1, d_2, d_3, \dots, d_n$, are the thicknesses for layers 1, 2, 3, ..., n , up to 100 feet, and $v_1, v_2, v_3, \dots, v_n$, are the seismic velocities (feet/second) for layers 1, 2, 3, ..., n . The detailed shear-wave model displays these calculated layer boundaries/depths and associated velocities (feet/second) for the 200-foot profile where locally measured. The constrained data is represented by the dark-gray shading on the shear-wave model. The associated Dispersion Curves (for both the active and passive methods) which show the data quality and picks, along with the resultant combined dispersion curve model, are also included within this appendix, for reference purposes.

SURVEY LINE PHOTOGRAPHS



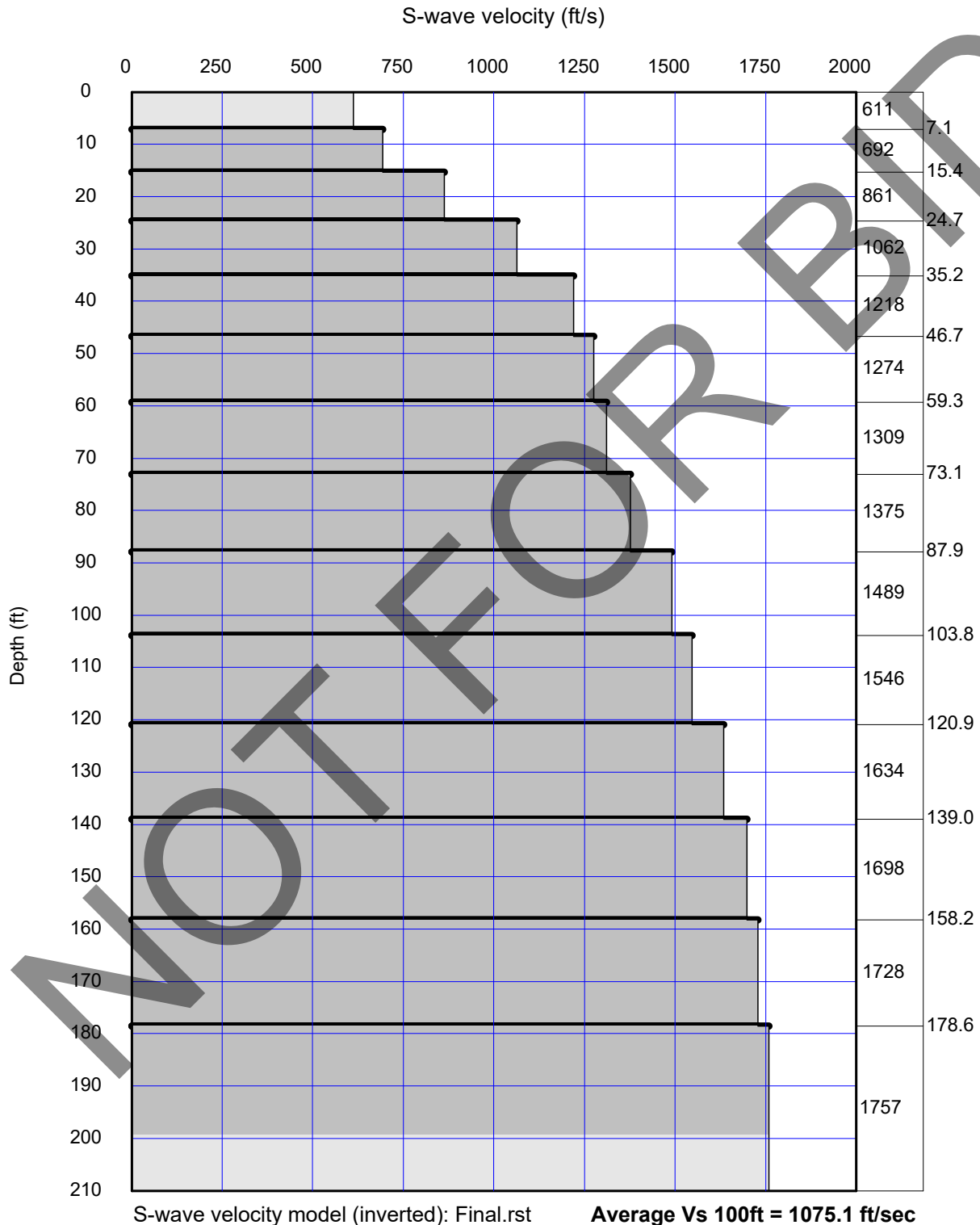
View looking west along Seismic Line SW-1.



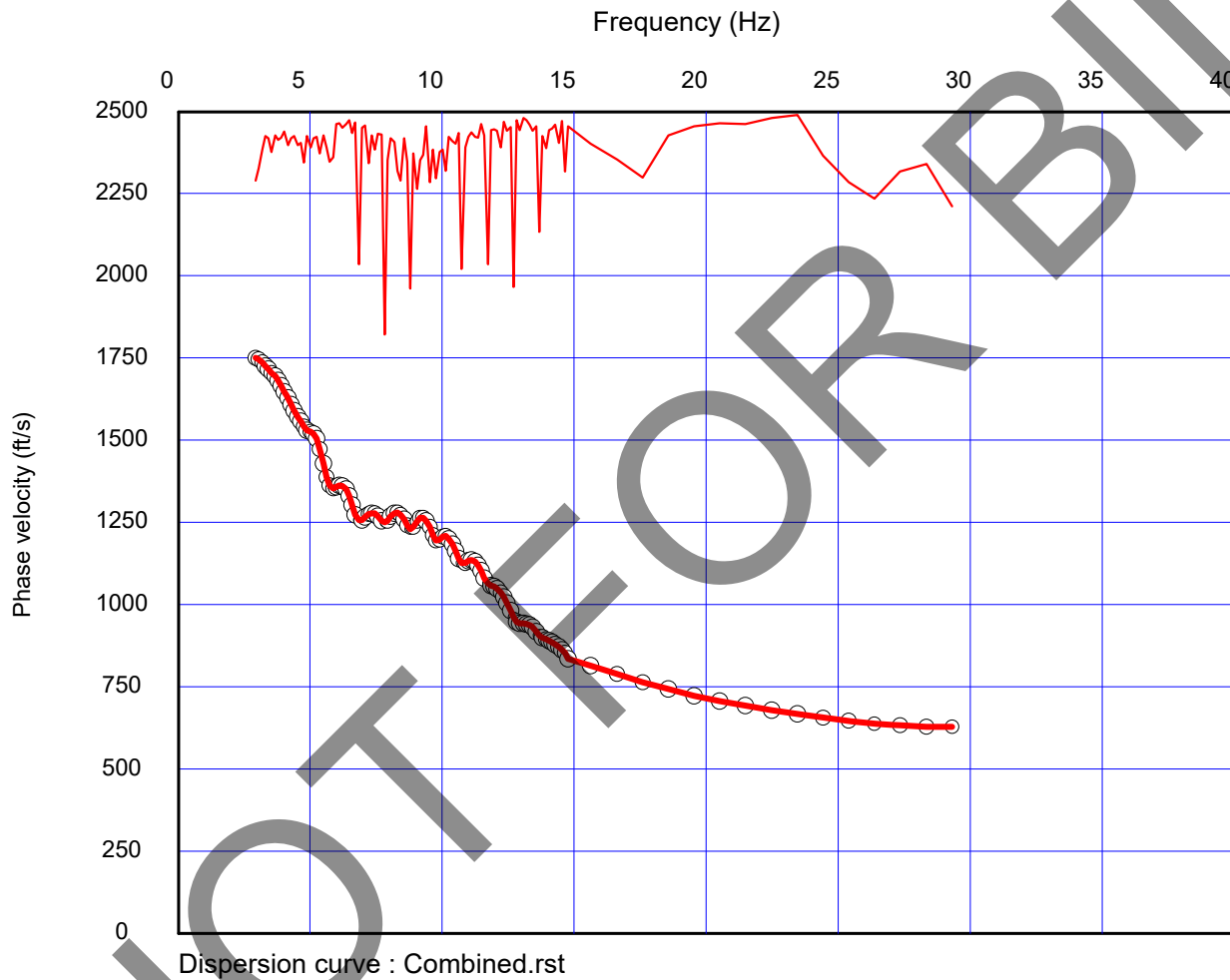
View looking east along Seismic Line SW-1.

SEISMIC LINE SW-1

SHEAR-WAVE MODEL

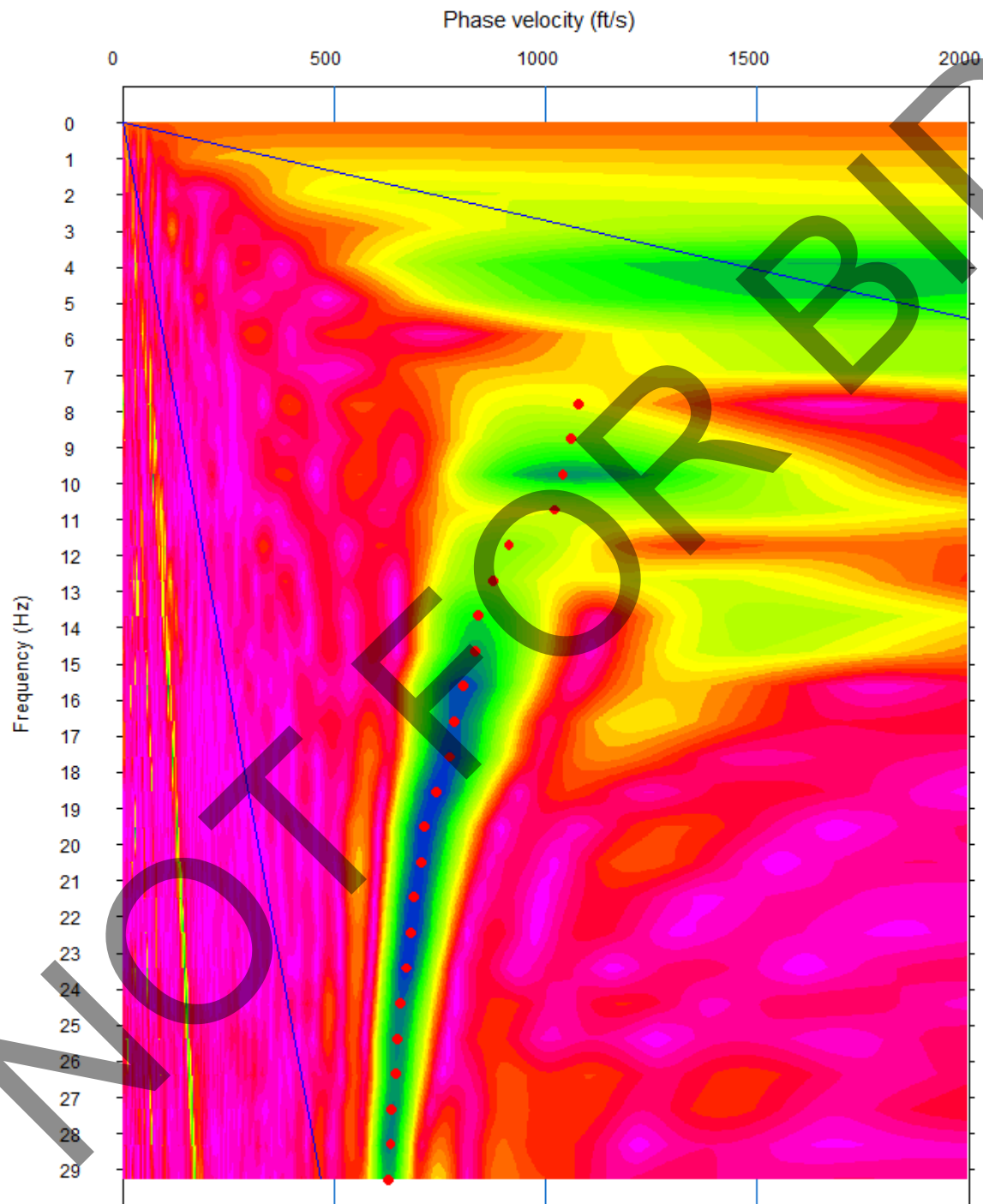


SEISMIC LINE SW-1



COMBINED DISPERSION CURVE

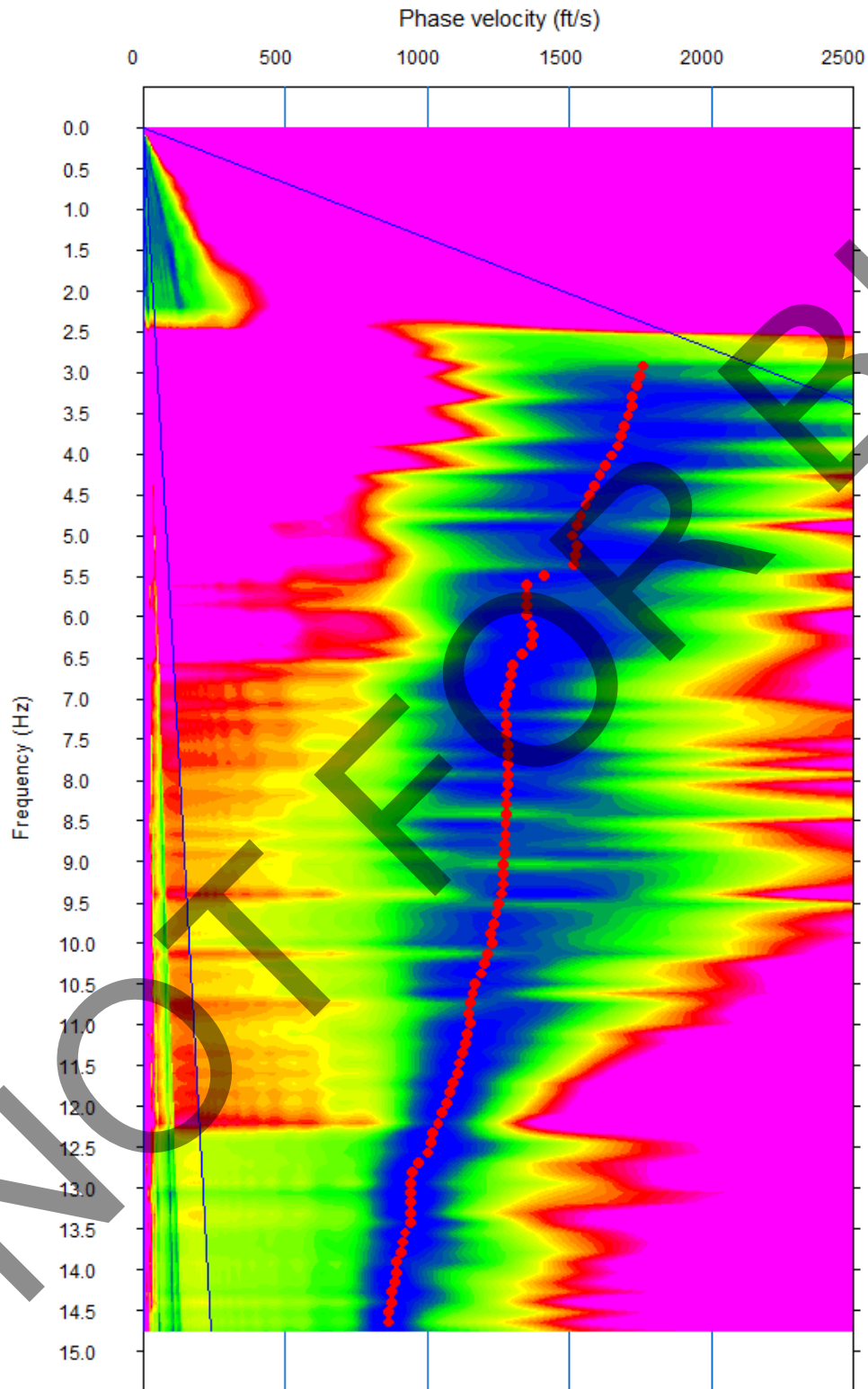
SEISMIC LINE SW-1



Dispersion Curve: Active.dat

ACTIVE DISPERSION CURVE

SEISMIC LINE SW-1



Dispersion Curve: Passive.dat

PASSIVE DISPERSION CURVE

APPENDIX B

SITE-SPECIFIC GROUND MOTION ANALYSIS

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SITE-SPECIFIC GROUND MOTION ANALYSIS

A detailed summary of the site-specific ground motion analysis, which follows Section 21 of the ASCE Standard 7-16 (2017) and the 2022 California Building Code is presented below, with the Seismic Design Parameters Summary included within this appendix following the summary text.

◆ Mapped Spectral Acceleration Parameters (CBC 1613A.2.1)-

Based on maps prepared by the U.S.G.S (Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for the 0.2 and 1-second Spectral Response Acceleration (5% of Critical Damping; Site Class B/C), a value of **2.506g** for the 0.2 second period (S_s) and **1.002g** for the 1.0 second period (S_1) was calculated (ASCE 7-16 Figures 22-1, 22-2 and CBC 1613A.2.1).

◆ Site Classification (CBC 1613A.2.2 & ASCE 7-16 Chapter 20)-

Based on the site-specific measured shear-wave value of 1,075.1 feet/second (327.7 meters/second), the soil profile type used should be Site Class “D.” This Class is defined as having the upper 100 feet (30 meters) of the subsurface being underlain by “stiff soil” with average shear-wave velocities of 600 to 1,200 feet/second (180 to 360 meters/second), as detailed within Appendix A.

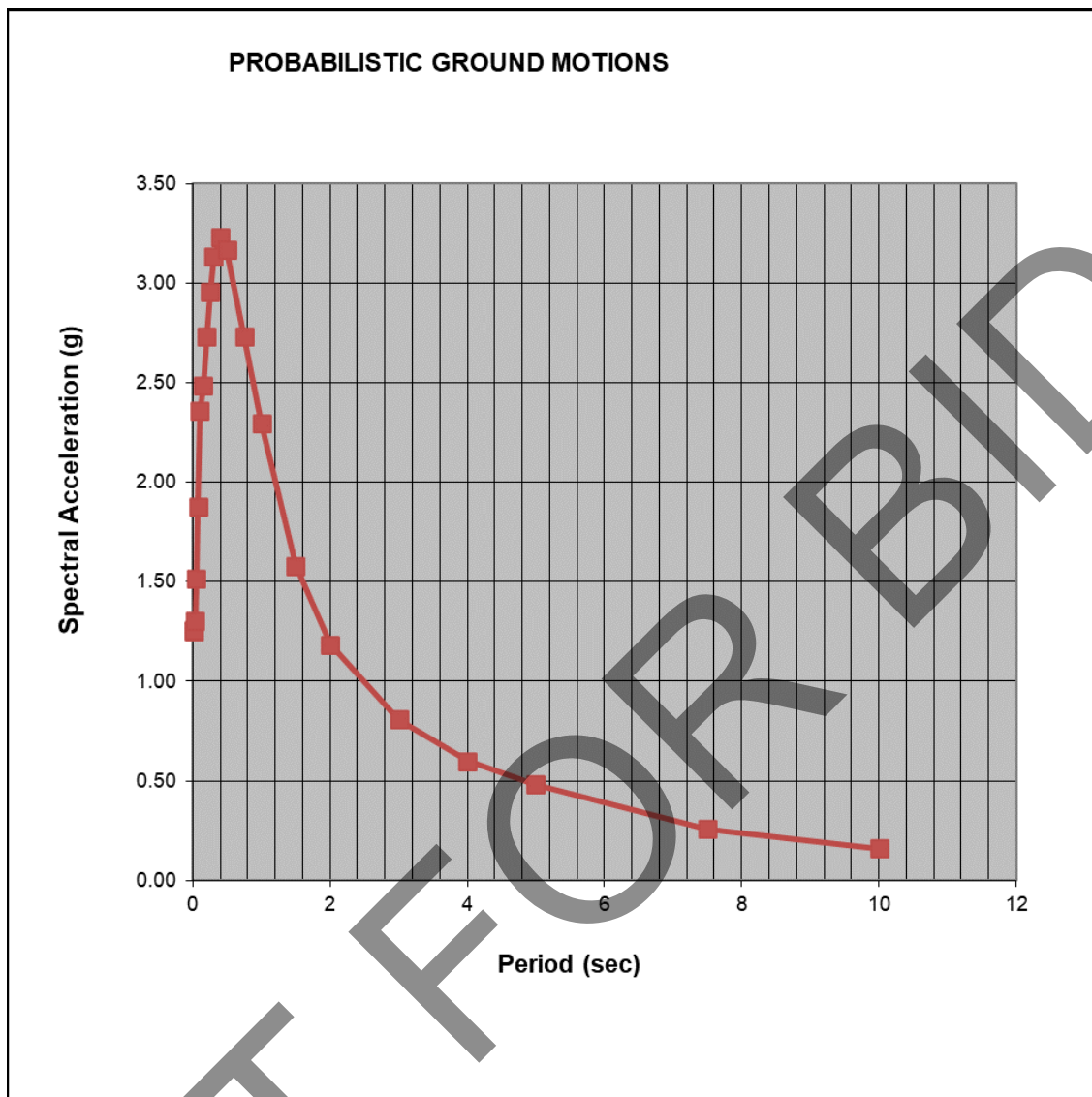
◆ Site Coefficients (CBC 1613A.2.3)-

Based on CBC Tables 1613A.2.3(1) and 1613A.2.3(2), the site coefficient $F_a = 1.2$ and $F_v = 1.7$, respectively.

◆ Probabilistic (MCE_R) Ground Motions (ASCE 7 Section 21.2.1)-

Per Section 21.2.1, the probabilistic MCE spectral accelerations shall be taken as the spectral response accelerations in the direction of maximum response represented by a five percent damped acceleration response spectrum that is expected to achieve a one percent probability of collapse within a 50-year period.

The probabilistic analysis included the use of the Open Seismic Hazard Analysis (OpenSHA). The selected Earthquake Rupture Forecast (ERF) was UCERF3 along with a Probability of Exceedance of 2% in 50 Years. The average of four Next Generation Attenuation West-2 Relations (2014 NGA) were utilized to produce a response spectrum. These included Chiou & Youngs (2014), Abrahamsom et al. (2014), Campbell & Bozorgnia (2014), Boore et al. (2014), and Campbell & Bozorgnia (2014). The Probabilistic Risk Targeted Response Spectrum was determined as the product of the ordinates of the probabilistic response spectrum and the applicable risk coefficient (C_R). These values were then modified to produce a spectrum based upon the maximum rotated components of ground motion. The resulting MCE_R Response Spectrum is indicated below:



◆ **Deterministic Spectral Response Analyses (ASCE 7 Section 21.2.2)-**

The deterministic MCE_R response acceleration at each period shall be calculated as an 84th-percentile 5 percent damped spectral response acceleration in the direction of maximum horizontal response computed at that period. The largest such acceleration calculated for the characteristic earthquakes on all known active faults within the region shall be used. Analyses were conducted using the average of four Next Generation Attenuation West-2 Relations (2014 NGA), including Chiou & Youngs (2014), Abrahamsom et al. (2014), Boore et al. (2014) and Campbell & Bozorgnia (2014).

Based on our review of the Fault Section Database within the Uniform California Earthquake Rupture Forecast (UCERF 3; Field et al., 2013), published geologic data, and based on the length (combined segments) and maximum magnitude of the San Andreas Fault Zone (southern section) located 1.8 kilometers to the northeast, a moment magnitude (M_w) used for this fault was 8.1.

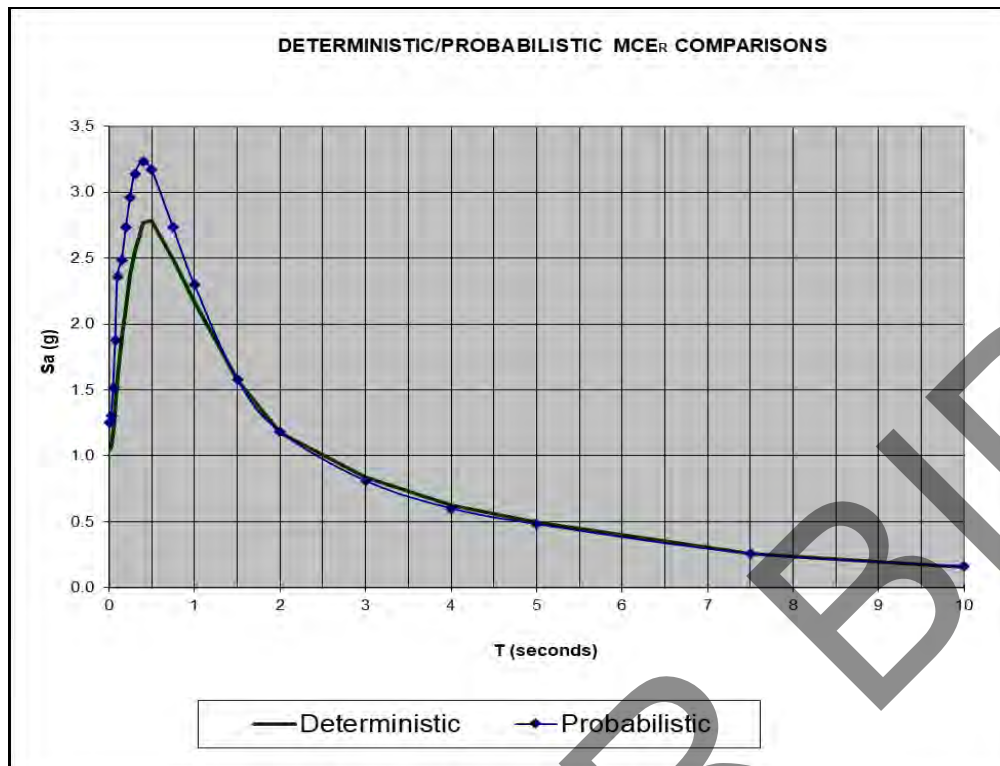
◆ **Site Specific MCE_R (ASCE 7 Section 21.2.3)-**

The site-specific MCE_R spectral response acceleration at any period, S_{aM} , shall be taken as the lesser of the spectral response accelerations from the probabilistic ground motions of Section 21.2.1 and the deterministic ground motions of Section 21.2.2. The deterministic ground motions were compared with the probabilistic ground motions that were determined in accordance with Section 21.2.1.

Comparison of Deterministic MCE_R Values with Probabilistic MCE_R Values - Section 21.2.3

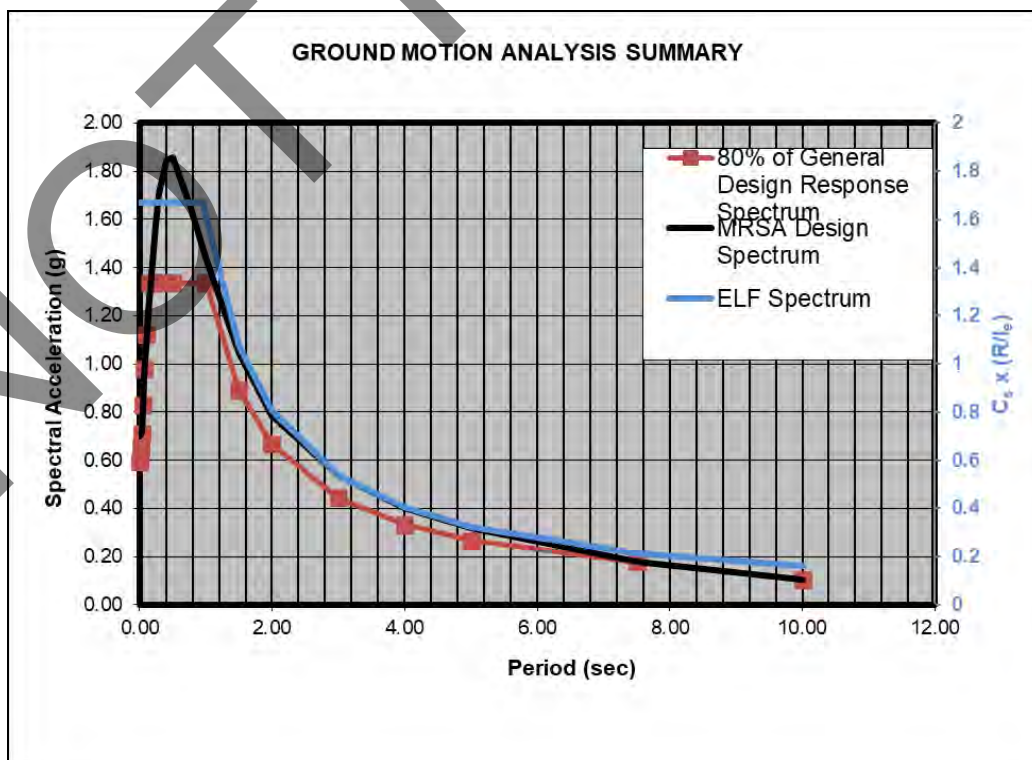
Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE_R)	Governing Method	
T	MCE_R	MCE_R			
0.010	1.05	1.25	1.05	Deterministic Governs	
0.020	1.06	1.26	1.06	Deterministic Governs	
0.030	1.09	1.31	1.09	Deterministic Governs	
0.050	1.21	1.52	1.21	Deterministic Governs	
0.075	1.42	1.88	1.42	Deterministic Governs	
0.100	1.61	2.36	1.61	Deterministic Governs	
0.150	1.90	2.49	1.90	Deterministic Governs	
0.200	2.13	2.73	2.13	Deterministic Governs	
0.250	2.37	2.96	2.37	Deterministic Governs	
0.300	2.56	3.13	2.56	Deterministic Governs	
0.400	2.77	3.23	2.77	Deterministic Governs	
0.500	2.78	3.17	2.78	Deterministic Governs	
0.750	2.49	2.73	2.49	Deterministic Governs	
1.000	2.16	2.30	2.16	Deterministic Governs	
1.500	1.57	1.58	1.57	Deterministic Governs	
2.000	1.18	1.18	1.18	Deterministic Governs	
3.000	0.84	0.81	0.81	Probabilistic Governs	
4.000	0.63	0.60	0.60	Probabilistic Governs	
5.000	0.49	0.48	0.48	Probabilistic Governs	
7.500	0.26	0.26	0.26	Deterministic Governs	
10.000	0.15	0.16	0.15	Deterministic Governs	

These are plotted in the following diagram:



◆ **Design Response Spectrum (ASCE 7 Section 21.3)-**

In accordance with Section 21.3, the Design Response Spectrum was developed by the following equation: $S_a = 2/3 S_{aM}$, where S_{aM} is the MCE_R spectral response acceleration obtained from Section 21.1 or 21.2. The design spectral response acceleration shall not be taken less than 80 percent of S_a . These are plotted and compared with 80% of the CBC Spectrum values in the following diagram:



◆ **Design Acceleration Parameters (ASCE 7 Section 21.4)-**

Where the site-specific procedure is used to determine the design ground motion in accordance with Section 21.3, the parameter S_{DS} shall be obtained from the site-specific spectra at a period of 0.2 s, except that it shall not be taken less than 90 percent of the peak spectral acceleration, S_a , at any period larger than 0.2 s. The parameter S_{D1} shall be taken as the greater of the products of $S_a * T$ for periods between 1 and 5 seconds. The parameters S_{MS} , and S_{M1} shall be taken as 1.5 times S_{DS} and S_{D1} , respectively. The values so obtained shall not be less than 80 percent of the values determined in accordance with Section 11.4.4 for S_{MS} , and S_{M1} and Section 11.4.5 for S_{DS} and S_{D1} .

◆ **Site Specific Design Parameters -**

For the 0.2 second period (S_{DS}), the maximum average acceleration for any period exceeding 0.2 seconds was 1.86g occurring at $T=0.50$ seconds. This was multiplied by 0.9 to produce a value of 1.67g making this the applicable value. A value of 1.62g was calculated for S_{D1} at a period of 1 second (ASCE 7-16, 21.4). For the MCE_R 0.2 second period, a value of 2.506g (S_{MS}) was computed, along with a value of 2.429g (S_{M1}) for the MCE_R 1.0 second period was also calculated (ASCE 7-16, 21.2.3).

◆ **Site-Specific MCE_G Peak Ground Accelerations (ASCE 7 Section 21.5)-**

The probabilistic geometric mean peak ground acceleration (2 percent probability of exceedance within a 50-year period) was calculated as 1.24g. The deterministic geometric mean peak ground acceleration (largest 84th percentile geometric mean peak ground acceleration for characteristic earthquakes on all known active faults within the site region) was calculated as 0.95g. The site-specific MCE_G peak ground acceleration was calculated to be **0.95g**, which was determined by using the lesser of the probabilistic (1.24g) or the deterministic (0.95g) geometric mean peak ground accelerations, but not taken as less than 80 percent of PGA_M (i.e., $1.14g \times 0.80 = 0.92g$).

SEISMIC DESIGN PARAMETERS SUMMARY

Project: San Bernardino County Fire Station #227 Latitude: 34.1601
 Project #: 244073-1 Longitude: -117.2866
 Date: 7/14/2024

CALIFORNIA BUILDING CODE CHAPTER 16/ASCE7-16

Mapped Acceleration Parameters per ASCE 7-16, Chapter 22

S_s	2.506	Figure 22-1
S_1	1.002	Figure 22-2

Site Class per Table 20.3-1

Site Class = D - Stiff Soil

Site Coefficients per ASCE 7-16 CHAPTER 11

F_a	1	Table 11.4-1	=	1	For Site Specific Analysis per ASCE7-16 21.3
F_v	1.7	Table 11.4-2	=	2.50	For Site Specific Analysis per ASCE7-16 21.3

Mapped Design Spectral Response Acceleration Parameters

S_{Ms}	2.506	Equation 11.4-1		2.506	For Site Specific Analysis per ASCE7-16 21.3
S_{M1}	1.703	Equation 11.4-2		2.505	For Site Specific Analysis per ASCE7-16 21.3

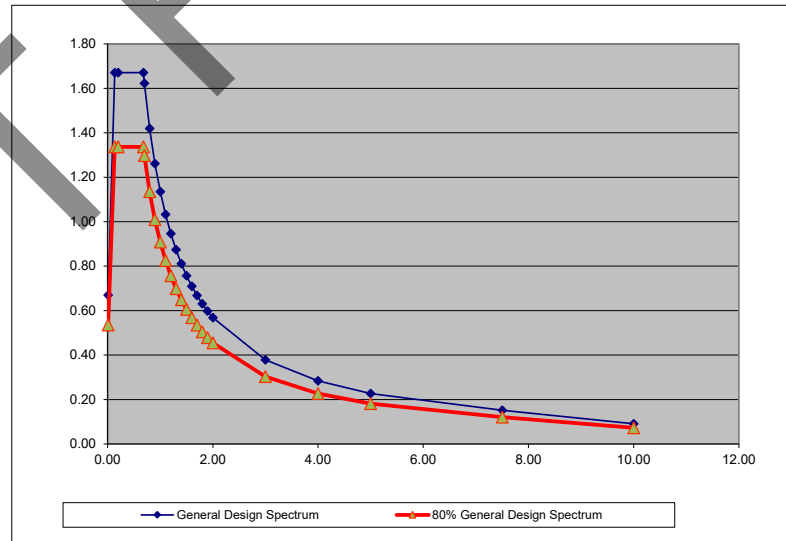
S_{DS}	1.671	Equation 11.4-3
S_{D1}	1.136	Equation 11.4-4

Period (T)	S_a (ASCE7-16 11.4.6)	80% General Design Spectrum
0.01	0.67	0.54
0.14	1.67	1.34
0.20	1.67	1.34
0.68	1.67	1.34
0.70	1.62	1.30
0.80	1.42	1.14
0.90	1.26	1.01
1.00	1.14	0.91
1.10	1.03	0.83
1.20	0.95	0.76
1.30	0.87	0.70
1.40	0.81	0.65
1.50	0.76	0.61
1.60	0.71	0.57
1.70	0.67	0.53
1.80	0.63	0.50
1.90	0.60	0.48
2.00	0.57	0.45
3.00	0.38	0.30
4.00	0.28	0.23
5.00	0.23	0.18
7.50	0.15	0.12
10.00	0.09	0.07

T_0	0.136	sec
T_S	0.680	sec
T_L	8	sec
PGA	1.04	g
F_{PGA}	1.1	
C_{RS}	0.905	
C_{R1}	0.884	

From Fig 22-12

From Table 11.8-1
 Figure 22-17
 Figure 22-18



ASCE 7-16 - RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION ANALYSIS

Use Maximum Rotated Horizontal Component?* (Y/N)

Y

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relat Earthquake Rupture Forecast - UCERF3 Mean, FM 3.1 & 3.2

PROBABILISTIC MCER per 21.2.1.1 Method 1

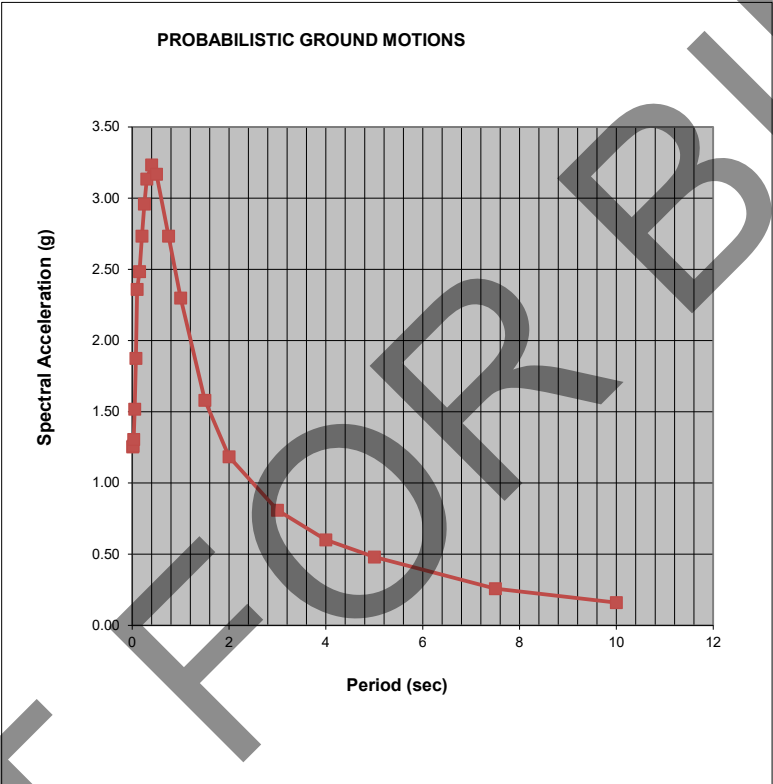
Risk Coefficients taken from Figures 22-18 and 22-19 of ASCE 7-16

OpenSHA data

2% Probability Of Exceedance in 50 years

Maximum Rotated Horizontal Component determined per ASCE7-16

T	Sa 2% in 50	MCER
0.01	1.39	1.25
0.02	1.39	1.26
0.03	1.44	1.31
0.05	1.68	1.52
0.08	2.07	1.88
0.10	2.37	2.36
0.15	2.75	2.49
0.20	3.02	2.73
0.25	3.27	2.96
0.30	3.47	3.13
0.40	3.59	3.23
0.50	3.53	3.17
0.75	3.07	2.73
1.00	2.60	2.30
1.50	1.79	1.58
2.00	1.34	1.18
3.00	0.92	0.81
4.00	0.68	0.60
5.00	0.54	0.48
7.50	0.29	0.26
10.00	0.18	0.16



S _s =	3.02	2.73
S ₁ =	2.60	2.30
PGA	1.24 g	

Risk Coefficients:		
C _{RS}	0.905	Figure 22-18
C _{R1}	0.884	Figure 22-19
F _a =	1	Table 11.4-1
Is Sa _(max) <1.2XF _a ?	NO	

Get from Mapped Values

Per ASCE7-16 - 21.2.3

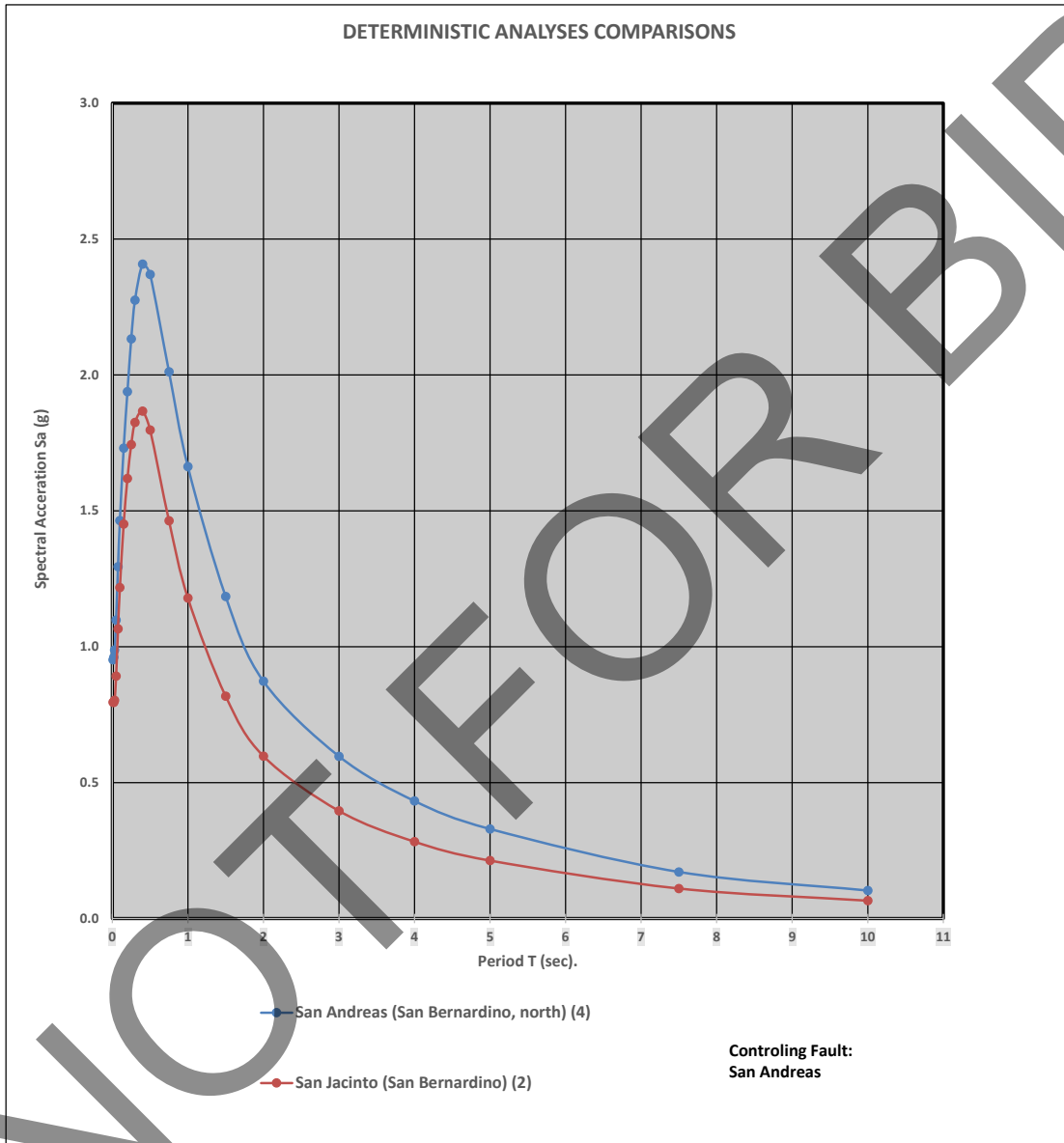
If "YES", Probabilistic Spectrum prevails

DETERMINISTIC MCE per 21.2.2

Preliminary Assessment:

Fault	Distance (km)
San Andreas (San Bernardino, north) (4)	1.80
San Jacinto (San Bernardino) (2)	6.30

The Probabilistic Analyses revealed 5 faults contributing more than 10% to the seismic hazard. These were considered in the Deterministic Analyses along with the Newport-Inglewood Fault.



Input Parameters		San Andreas (San Bernardino, north) (4)	San Jacinto (San Bernardino) (2)
Fault			
M	= Moment magnitude	8.1	7.8
R_{RUP}	= Closest distance to coseismic rupture (km)	1.8	6.3
R_{JB}	= Closest distance to surface projection of coseismic rupture (km)	1.8	6.3
R_x	= Horizontal distance to top edge of rupture measured perpendicular to strike (km)	1.8	6.3
U	= Unspecified Faulting Flag (Boore et.al.)	0	0
F_{RV}	= Reverse-faulting factor: 0 for strike slip, normal, normal-oblique; 1 for reverse, reverse-oblique and thrust	0	0
F_{NM}	= Normal-faulting factor: 0 for strike slip, reverse, reverse-oblique and thrust; 1 for normal and normal-oblique	0	0
F_{HW}	= Hanging-wall factor: 1 for site on down-dip side of top of rupture; 0 otherwise, used in AS08 and CY08	0	0
Z_{TOR}	= Depth to top of coseismic rupture (km)	0	0
δ	= Average dip of rupture plane (degrees)	90	90
V_{S30}	= Average shear-wave velocity in top 30m of site profile	327.7	327.7
F_{Measured}		1	1
Z_{1.0}	= Depth to Shear Wave Velocity of 1.0 km/sec (km)	0.25	0.25
Z_{2.5}	= Depth to Shear Wave Velocity of 2.5 km/sec (km)	0.35	0.35
Site Class		D	D
W (km)	= Fault rupture width (km)	12.5	16.5
F_{AS}	= 0 for mainshock; 1 for aftershock	0	0
σ	=Standard Deviation	1	1

Deterministic Summary - Section 21.2.2 (Supplement 1)

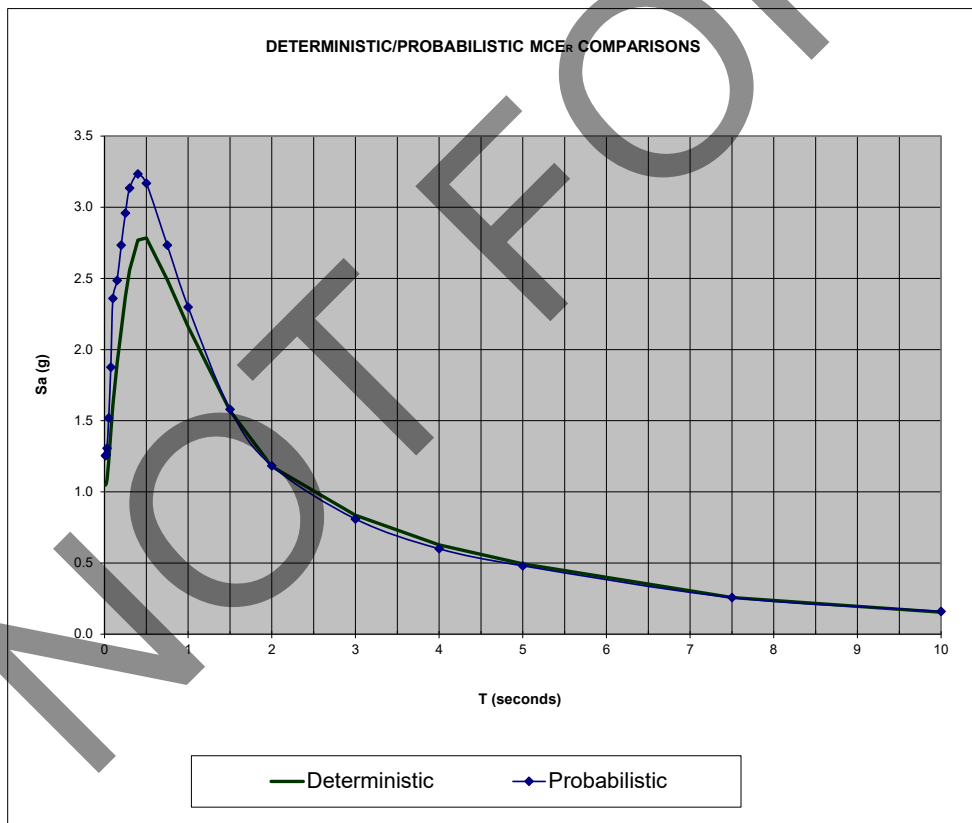
T	San Andreas (San Bernardino, north) (4)	San Jacinto (San Bernardino) (2)	Maximum S _a (Average)	Corrected* S _a (per ASCE7-16)	Scaled S _a (Average)	Controlling Fault
0.010	0.95	0.80	0.95	1.05	1.05	San Andreas (San
0.020	0.96	0.79	0.96	1.06	1.06	San Andreas (San
0.030	0.99	0.80	0.99	1.09	1.09	San Andreas (San
0.050	1.10	0.89	1.10	1.21	1.21	San Andreas (San
0.075	1.29	1.07	1.29	1.42	1.42	San Andreas (San
0.100	1.46	1.22	1.46	1.61	1.61	San Andreas (San
0.150	1.73	1.45	1.73	1.90	1.90	San Andreas (San
0.200	1.94	1.62	1.94	2.13	2.13	San Andreas (San
0.250	2.13	1.74	2.13	2.37	2.37	San Andreas (San
0.300	2.28	1.83	2.28	2.56	2.56	San Andreas (San
0.400	2.41	1.87	2.41	2.77	2.77	San Andreas (San
0.500	2.37	1.80	2.37	2.78	2.78	San Andreas (San
0.750	2.01	1.46	2.01	2.49	2.49	San Andreas (San
1.000	1.66	1.18	1.66	2.16	2.16	San Andreas (San
1.500	1.19	0.82	1.19	1.57	1.57	San Andreas (San
2.000	0.87	0.60	0.87	1.18	1.18	San Andreas (San
3.000	0.60	0.40	0.60	0.84	0.84	San Andreas (San
4.000	0.43	0.28	0.43	0.63	0.63	San Andreas (San
5.000	0.33	0.21	0.33	0.49	0.49	San Andreas (San
7.500	0.17	0.11	0.17	0.26	0.26	San Andreas (San
10.000	0.10	0.07	0.10	0.15	0.15	San Andreas (San
PGA	0.95	0.76	0.95		0.95	g
Max Sa=	2.78					
Fa =	1.00					Per ASCE7-16 21.2.2
1.5XFa=	1.5					
Scaling Factor=	1.00					

* Correction is the adjustment for Maximum Rotated Value if Applicable

SITE SPECIFIC MCE_R - Compare Deterministic MCE_R Values (S_a) with Probabilistic MCE_R Values (S_a) per 21.2.3

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relat

Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE_R)	Governing Method
T	MCE_R	MCE_R		
0.010	1.05	1.25	1.05	Deterministic Governs
0.020	1.06	1.26	1.06	Deterministic Governs
0.030	1.09	1.31	1.09	Deterministic Governs
0.050	1.21	1.52	1.21	Deterministic Governs
0.075	1.42	1.88	1.42	Deterministic Governs
0.100	1.61	2.36	1.61	Deterministic Governs
0.150	1.90	2.49	1.90	Deterministic Governs
0.200	2.13	2.73	2.13	Deterministic Governs
0.250	2.37	2.96	2.37	Deterministic Governs
0.300	2.56	3.13	2.56	Deterministic Governs
0.400	2.77	3.23	2.77	Deterministic Governs
0.500	2.78	3.17	2.78	Deterministic Governs
0.750	2.49	2.73	2.49	Deterministic Governs
1.000	2.16	2.30	2.16	Deterministic Governs
1.500	1.57	1.58	1.57	Deterministic Governs
2.000	1.18	1.18	1.18	Deterministic Governs
3.000	0.84	0.81	0.81	Probabilistic Governs
4.000	0.63	0.60	0.60	Probabilistic Governs
5.000	0.49	0.48	0.48	Probabilistic Governs
7.500	0.26	0.26	0.26	Deterministic Governs
10.000	0.15	0.16	0.15	Deterministic Governs



DESIGN RESPONSE SPECTRUM per Section 21.3

DESIGN ACCELERATION PARAMETERS per Section 21.4 (MRSA)

Period	$2/3 \cdot MCE_R$	80% General Design Response Spectrum (per ASCE 7-16 23.3-1)	Design Response Spectrum	TXSa
0.01	0.70	0.57	0.70	
0.02	0.71	0.61	0.71	
0.03	0.72	0.65	0.72	
0.05	0.81	0.74	0.81	
0.08	0.95	0.84	0.95	
0.10	1.07	0.94	1.07	
0.15	1.27	1.14	1.27	
0.20	1.42	1.34	1.42	
0.25	1.58	1.34	1.58	
0.30	1.71	1.34	1.71	
0.40	1.85	1.34	1.85	
0.50	1.86	1.34	1.86	
0.75	1.66	1.34	1.66	
1.00	1.44	1.34	1.44	1.44
1.50	1.05	0.89	1.05	1.57
2.00	0.79	0.67	0.79	1.57
3.00	0.54	0.45	0.54	1.62
4.00	0.40	0.33	0.40	1.60
5.00	0.32	0.27	0.32	1.60
7.50	0.17	0.18	0.18	
10.00	0.10	0.11	0.11	

Highest value of S_a for any period exceeding 0.2 sec. =

90% of Highest Value =

80% of Mapped S_{DS} =

Maximum TXSa from $T=1s-5s$ =

80% of Mapped S_{D1} =

S_{DS} =	1.67
S_{D1} =	1.62
T_s =	0.97

S_{MS} =	2.506
S_{M1} =	2.429

PGA Determination:

Site Coefficient F_{PGA} =

Mapped PGA =

PGA_M =

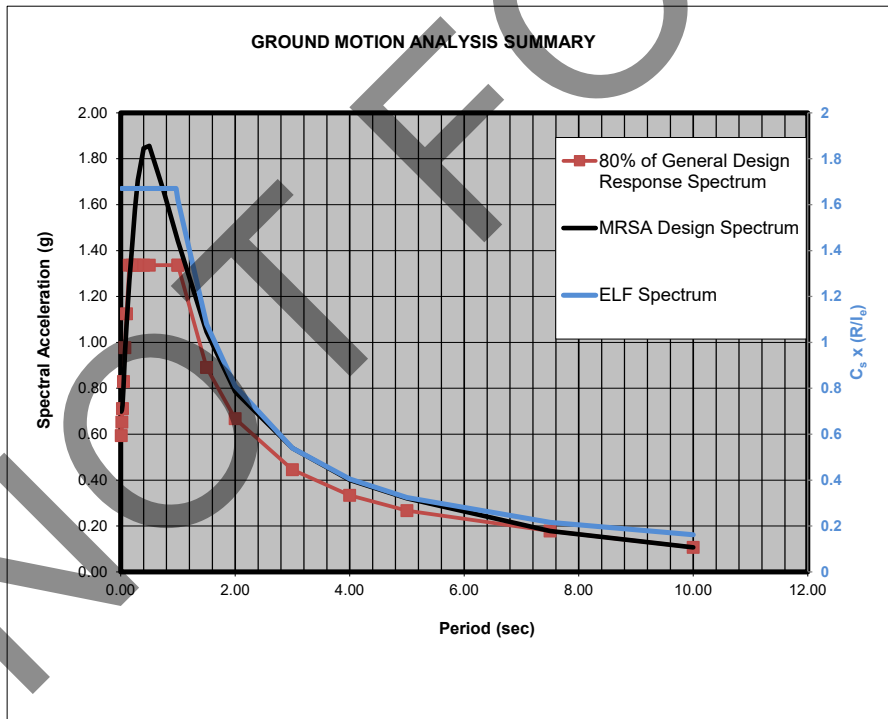
Deterministic PGA =

Probabilistic PGA =

Lesser of Deterministic/Probabilistic =

80% of PGA_M =

MCE_G PGA =



SUMMARY OF SITE SPECIFIC GROUND MOTION HAZARD ANALYSIS DATA

1	2	3		4	5	6	7	8	9	10	11	12
Period (sec)	Mapped MCE _R Spectrum	Mapped Design Spectrum	Period (sec)	Risk Coefficient C _R	Scaled MCE _R Deterministic Spectrum	Probabilistic MCE _R Spectrum	Probabilistic w/Risk Coefficient C _R	84th Percentile Deterministic Spectrum	2/3 Site Specific MCE _R Spectrum	80% of General Design Spectrum	Site Specific MCE _R Spectrum	Design Response Spectrum
0.01	1.00	0.67	0.01	0.905	1.05	1.25	1.25	1.05	0.70	0.57	1.05	0.70
0.14	2.51	1.67	0.02	0.905	1.06	1.26	1.26	1.06	0.71	0.61	1.06	0.71
0.20	2.51	1.67	0.03	0.905	1.09	1.31	1.31	1.09	0.72	0.65	1.09	0.72
0.68	2.51	1.67	0.05	0.905	1.21	1.52	1.52	1.21	0.81	0.74	1.21	0.81
0.70	2.43	1.62	0.08	0.905	1.42	1.88	1.88	1.42	0.95	0.84	1.42	0.95
0.80	2.13	1.42	0.10	0.905	1.61	2.36	2.36	1.61	1.07	0.94	1.61	1.07
0.90	1.89	1.26	0.15	0.905	1.90	2.49	2.49	1.90	1.27	1.14	1.90	1.27
1.00	1.70	1.14	0.20	0.905	2.13	2.73	2.73	2.13	1.42	1.34	2.13	1.42
1.10	1.55	1.03	0.25	0.904	2.37	2.96	2.96	2.37	1.58	1.34	2.37	1.58
1.20	1.42	0.95	0.30	0.902	2.56	3.13	3.13	2.56	1.71	1.34	2.56	1.71
1.30	1.31	0.87	0.40	0.900	2.77	3.23	3.23	2.77	1.85	1.34	2.77	1.85
1.40	1.22	0.81	0.50	0.897	2.78	3.17	3.17	2.78	1.86	1.34	2.78	1.86
1.50	1.14	0.76	0.75	0.891	2.49	2.73	2.73	2.49	1.66	1.34	2.49	1.66
1.60	1.06	0.71	1.00	0.884	2.16	2.30	2.30	2.16	1.44	1.34	2.16	1.44
1.70	1.00	0.67	1.50	0.884	1.57	1.58	1.58	1.57	1.05	0.89	1.57	1.05
1.80	0.95	0.63	2.00	0.884	1.18	1.18	1.18	1.18	0.79	0.67	1.18	0.79
1.90	0.90	0.60	3.00	0.884	0.84	0.81	0.81	0.84	0.54	0.45	0.81	0.54
2.00	0.85	0.57	4.00	0.884	0.63	0.60	0.60	0.63	0.40	0.33	0.60	0.40
3.00	0.57	0.38	5.00	0.884	0.49	0.48	0.48	0.49	0.32	0.27	0.48	0.32
4.00	0.43	0.28	7.50	0.884	0.26	0.26	0.26	0.26	0.17	0.18	0.27	0.18
5.00	0.34	0.23	10.00	0.884	0.15	0.16	0.16	0.15	0.10	0.11	0.16	0.11
7.50	0.23	0.15										
10.00	0.14	0.09										

APPENDIX C

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NOT FOR BIDDING



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Appendix "B"
EXERCISE EQUIPMENT
Specifications



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advancedexercise.com | 861 SouthPark Drive #100, Littleton, CO 80120 | 800.520.1112

CONSULTANT

Jarrett Tooley
jtooley@advancedexercise.com
Phone: 310.409.3732
Fax: 303.996.0063

**CONTRACTOR SHALL PURCHASE
AND INSTALL ALL EQUIPMENT
SHOWN HEREIN.**

Date: May 16, 2024
Quote Expires: 60 day(s)
Proposal # 074863-R8

BILL TO

SHIP TO

San Bernardino County Fire Station 227



CARDIO EQUIPMENT

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
IC-LFICGIC7-01	ICG	Life Fitness ICG IC7 Indoor Cycle 	• WattRate full color TFT computer screen • Bluetooth & ANT+ connect technology • Coach By Color • Self powered generator • Magnetic resistance • Steel frame • Full frame shrouds • Ergo-formed soft PVC handlebars • Unisex padded sport saddle • Max user weight: 330lbs • Dimensions: 52" x 20.5" x 40.2"		1	
100800	Octane Fitness	Octane Airdyne ADX 	• 26 Blade Performance • Self Powered Console with Programs • Multi Grip Movement Arms • Dimensions: 26"L x 55"W x 53"H • Machine Weight: 113lbs.		2	
ST1000	True Fitness	Stryker Slat Treadmill (Base) 	• Shock Absorbing Slat Design • Ergonomic Grips with Speed & Incline Controls • 3 Emergency Stops • Speed 1 -12mph • Incline 0% -25% • Dimensions: 72"L x 35"W x 64"H • Machine Weight: 599lbs. • Power: 120V 16A NEMA 5-20 Receptacle		1	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
C4LHITSTWH	True Fitness	Ignite Console for Stryker 	• LED Quick Speed/Elevation, No Programs		1	
00604500	True Fitness	Stryker Slat Treadmill Decline Kit	• Decline Kit for Styker Slat Treadmill • -3%-22% Decline & Incline		1	
2715	Concept 2	Concept2 SkiErg with PM5 (Black) 	• Black powder coated frame • Requires wall mounting unless optional floor stand is purchased • Includes PM5 Monitor • Wireless Heart Rate via ANT+ & Bluetooth Smart • Heart Rate transmitter not included • Ergonomic strapless handles • 20.5" W x 16" D x 83.5" H (Wall Mounted) • Unit weight 46lbs.		1	
2720	Concept 2	SkiErg Floor Stand 			1	
2712	Concept 2	Model D Indoor Rower with PM5 (Black) 	• Black powder coated frame • Includes PM5 Monitor • Wireless Heart Rate via ANT+ & Bluetooth Smart • Heart Rate transmitter not included • Adjustable Footrest & Ergonomic Handle • Low profile design 14" seat height • Quick release frame lock & casters for storage • 96" L x 24" W x 14" Seat Height • Unit weight 57lbs.		1	



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STRENGTH EQUIPMENT

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
HDT-PSF	Hammer Strength	HD Athletic Perimeter Side Frame	Component for Perimeter Racks		5	
						
HDW-HR-SBC	Hammer Strength	Standard Half Rack Bar Catch (Pair)			2	
						
HDW-BSS	Hammer Strength	Standard Bar Support (Pair)			2	
HDU-WHS	Hammer Strength	Standard Length Weight Horn (Pair)	- Weight horn storage - Size (L x W x H): 8.5" x 2" x 8"		3	
HDU-WHXL	Hammer Strength	XL Length Weight Horn (Pair)	- XL weight horn storage - Size (L x W x H): 8.5" x 2" x 12"		2	
HDU-SBH	Hammer Strength	Single Bar Hanger	- Low profile bar storage mounted on an Xmember or Upright - Charcoal finish - Weight: 4 lbs		2	
HDT-XM42 / Option: -TS	Hammer Strength	42in Pro Xmember, Thick/Skinny			2	
HDT-XM42 / Option: -MB	Hammer Strength	42in Pro Xmember, Monkey Bar			2	
HDT-XM72 / OPTION: -MB	Hammer Strength	72in Pro Xmember, Monkey Bar			2	
HDU-SM72-2P	Hammer Strength	72in/183cm iD/NX 2 PIPE	- Great solution for storing bumper plates, wall balls, and med balls - The pipes have an 8" opening and are spaced 10" on center - Add moveable Bumper Plate dividers - Max Capacity 42": 1,485 lbs - Max Capacity 72": 1,485 lbs - Comes in both 42" and 72" options		2	
						



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
HDU-SM72-DBT	Hammer Strength	72in/183cm iD/NX Dumbbell Tray 	- Built for anti-roll dumbbells - They can be installed at a 10 degree angle or flat - Max Capacity 42": 680 lbs - Max Capacity 72": 680 lbs - Comes in both 42" and 72" options		4	
HDU-SM72-ACT	Hammer Strength	72in/183cm iD/NX Accessory Tray 	- Provides 8.5" of flat surface for a variety of soft and hard accessories - Each tray is lined with a hard rubber surface to protect finishes on trays - Max Capacity 42": 680 lbs - Max Capacity 72": 680 lbs - Comes in both 42" and 72" options		2	
HDU-BPD	Hammer Strength	Bumper Plate Divider 	- Add moveable Bumper Plate dividers to help secure plates and partition accessory sections - Compatible with 2 Pipe Storage		4	
HDU-PPF	Hammer Strength	Power Pivot (Bolt On)	- Provides rotating mount for barbell - Size (L x W x H): 21.7" x 4.5" x 10.7" - Weight: 19 lbs		1	
HDU-DIP	Hammer Strength	Dip Handle	- Attaches between two uprights to allow users a space to perform dips - Size (L x W x H): 47.2" x 23.4" x 5.9" - Weight: 27.7 lbs		1	
HDU-WBT	Hammer Strength	Wall Ball Target	- To be utilized with Wall Balls up to 30 lbs - HS Logo marks 10' line - Vinyl pre stressed wrap - Size (L x W x H): 45" x 16" x 9.5" - Weight: 35 lbs		1	
HDU-MAB	Hammer Strength	Multi Adjustable Bench 	- Size (L x W x H): Footprint (L x W x H): 52.5" x 22.2" x 18.5" - Weight: 85 lbs - Back pad adjusts from -10 to 15, 30, 45, 60 and 75-degree pressing angles - Seat pad adjusts from 0 to 30 degrees		2	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
PL-CALF	Hammer Strength	Seated Calf Raise 	• 11-gauge steel frame with powder coat finish • Thigh pad restraint adjusts to accommodate different user sizes • Two areas to load plates • Plate Loaded with 60 lb. starting resistance • Made in USA • 50"L x 30"W x 55"H • Machine weight: 200 lbs		1	
PL-BSQ	Hammer Strength	Hammer Strength Plate Loaded Belt Squat 	• Front and rear weight rods for increased load • 4 belt anchor points • Belt and hook storage hanger • Dimensions 78"D x 63"W x 64"H • Weight 425lbs		1	
PL-BSQ-4002	Hammer Strength	Belt Squat Optional Dip Attachment			1	
CMDAP	Life Fitness	Signature Series Cable Motion Dual Adjustable Pulley 	• Oval frame 11-gauge tubing with powder coat finish • 1" solid steel weight plates • Rear weight stack shrouds • 22 adjustment positions per column • 1:4 resistance ratio • 3 position pull up station • Accessory kit & storage included • Machine Weight: 1265lb. • Weight Stack: 2 x 390lb. • Dimensions with pull-up handles: 44"L x 62"W x 95"H • Made in USA		1	
OP-LCE	Life Fitness	Axiom Leg Curl/Extension 	• 11-gauge oval tubing steel frames • Low Profile 53 inch tower height • Solid Steel Weight stacks with 7.5 lb drop down increment weight • Placards with QR code/ NFC Chip, for product usage instructions • Integrated storage in Tower top cap • Standard rear shroud and optional full shroud		1	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
OP-LR	Life Fitness	Axiom Pulldown/Row 	• 11-gauge oval tubing steel frames • Low Profile 53 inch tower height • Solid Steel Weight stacks with 7.5 lb drop down increment weight • Placards with QR code/ NFC Chip, for product usage instructions • Integrated storage in Tower top cap • Standard rear shroud and optional full shroud • Dimensions: 91"x35"x85" • Weight 452 lbs		1	
SMSS-CORE	Life Fitness	Signature Modular Storage System - Core 	• Weight: 80 lbs (36 kg) • Depth 27.3" x 53.5" x 73" (69 x 136 x 1856 cm)		1	
SMSS-ACT	Life Fitness	Accessory Shelf 	• Ideal for general accessory storage including Kettlebells, slam bags, hex/non-rolling dumbbells, med balls, wall balls, foam rollers, etc. • Usable flat surface space: 46" x 13" (116 cm x 33cm)		4	
SMSS-DR	Life Fitness	Dual Rail Shelf 	• Ideal for ball storage • 5.75" (15 cm) between rails		1	



FREE WEIGHTS

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
MISC	Advanced Exercise	Troy Barbell - 8 Sided Urethane DB 5-50lb. Set - SD-005U - SD-050U			1	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
MISC	Advanced Exercise	Troy Barbell - 8 Sided Urethane DB 55-100lb. Set - SD-055U - SD-100U			1	
KB-010G2	Troy Barbell	Cast Iron Kettlebell 10lb.	• Black Cast Iron Kettlebell		2	
						
KB-020G2	Troy Barbell	Cast Iron Kettlebell 20lb.	• Black Cast Iron Kettlebell		2	
						
KB-035G2	Troy Barbell	Cast Iron Kettlebell 35lb.	• Black Cast Iron Kettlebell		2	
						
KB-050G2	Troy Barbell	Cast Iron Kettlebell 50lb.	• Black Cast Iron Kettlebell		2	
						
KB-070G2	Troy Barbell	Cast Iron Kettlebell 70lb.	• Black Cast Iron Kettlebell		2	
						



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
KB-090G2	Troy Barbell	Cast Iron Kettlebell 90lb.	• Black Cast Iron Kettlebell		2	
						
GBO-010SBP	Troy Barbell	10 lb Rubber Bumper Plate	• Solid Rubber Black Bumper Plate with Steel Insert • USA branded		4	
						
GBO-025SBP	Troy Barbell	25 lb Rubber Bumper Plate	• Solid Rubber Black Bumper Plate with Steel Insert • USA branded		4	
						
GBO-045SBP	Troy Barbell	45 lb Rubber Bumper Plate	• Solid Rubber Black Bumper Plate with Steel Insert • USA branded		12	\$
						
GO-002U	Troy Barbell	Urethane Encased Olympic Grip Plate 2.5lb.			8	
						



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
GO-005U	Troy Barbell	Urethane Encased Olympic Plate 5lb.			12	
						
GO-010U	Troy Barbell	Urethane Encased Olympic Plate 10lb.			16	
						
GO-025U	Troy Barbell	Urethane Encased Olympic Grip Plate 25lb.			16	\$
						
GO-045U	Troy Barbell	Urethane Encased Olympic Grip Plate 45lb.			16	\$
						
TOZ-47	Troy Barbell	47in. Commercial Olympic Curl Bar - Chrome			1	
						



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
OB-20KG-190CR	UMAX	20KG 7ft Olympic Training Bar, 28MM, Cerakote Red 	- Center Knurling - Needle Bearings 190,000 psi 4 Year Warranty		4	
OB-29KG-HEX	UMAX	Hex Trap Bar	2"x2" Tubing Frame - Chrome Sleeve 3 Year Warranty		1	
TOZ-60B	Troy Barbell	5ft. Deluxe Commercial Olympic Curl Bar - Black 			1	
MISC	Advanced Exercise	American Barbell - Safety Squat Bar - SB-SSB-VNYL			1	
MISC	Advanced Exercise	American Barbell - Swiss Bar - SB-FBB			1	
MISC	Advanced Exercise	American Barbell - Axel Bar - SB-AB			1	
40420	Power Systems	Olympic Bar Holder 			1	
PR2-RED	Avus Designs	Lock-Jaw Pro2 Barbell Collar (Red) 	2" Olympic Barbell Collar - Rubber Protective Lining - Lever and Lock Tab for Secure Lock - For Use with Olympic Lifts		5	



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TRAINING TOOLS

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
PWB-006	Troy Barbell	VTX Wall Ball 6lb.			1	
						
PWB-010	Troy Barbell	VTX Wall Ball 10lb.		30.00	1	
						
PWB-020	Troy Barbell	VTX Wall Ball 20lb.			1	
						
PWB-030	Troy Barbell	VTX Wall Ball 30lb.			1	
						
PWB-040	Troy Barbell	VTX Wall Ball 40lb.		1.00	1	
						



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
PWB-050	Troy Barbell	VTX Wall Ball 50lb. 			1	
GVFR	Troy Barbell	VTX Foam Roller 	• Lightweight and flexible • Weight 11lb • Dimensions 12" (L) x 4.72" (W)		2	
GVCT-UH	Troy Barbell	VTX Covered Resistance Tube (Extra Heavy) 	• Color coded resistance bands • Easy soft grip handles •		2	
GVCT-H	Troy Barbell	VTX Covered Resistance Tube (Heavy) 	• Color coded resistance bands • Easy soft grip handles •		2	
GVCT-M	Troy Barbell	VTX Covered Resistance Tube (Medium) 	• Color coded resistance bands • Easy soft grip handles •		2	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
GVCT-L	Troy Barbell	VTX Covered Resistance Tube (Light) 	• Color coded resistance bands • Easy soft grip handles •		2	
GVCT-UL	Troy Barbell	VTX Covered Resistance Tube (Extra Light) 	• Color coded resistance bands • Easy soft grip handles •		2	
MISC	Advanced Exercise	Troy - VTX Flat Band Mini Loop - Extra Heavy - GVFB-ML-XH			2	
MISC	Advanced Exercise	Troy - VTX Flat Band Mini Loop - Heavy - GVFB-ML-HVY			2	
MISC	Advanced Exercise	Troy - VTX Flat Band Mini Loop - Medium - GVFB-ML-MED			2	
MISC	Advanced Exercise	Troy - VTX Flat Band Mini Loop - Light - GVFB-ML-LIT			2	
GVSBL-XH	Troy Barbell	VTX Strength Band Loop - Extra Heavy (Black) 	• Continuous Latex Loop • Length 40"		2	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
GVSBL-HVY	Troy Barbell	VTX Strength Band Loop - Heavy (Egyptian Blue)	• Continuous Latex Loop • Length 40"		2	
						
GVSBL-MED	Troy Barbell	VTX Strength Band Loop - Medium (Spanish Orange)	• Continuous Latex Loop • Length 40"		2	
						
GVSBL-LIT	Troy Barbell	VTX Strength Band Loop - Light (Bitter Lemon)	• Continuous Latex Loop • Length 40"		2	
						
TPC	Troy Barbell	Tri Plyo Cube - 20",24",30"	• Vinyl Covered High Density Foam • 20 in X 24 in. X 30 in. Landing Areas		2	
						
ROPE1-40G	Troy Barbell	40 ft Battle Rope 1.5 inch Diameter	• Fray Resistant Material • Vinyl Grips • 17lbs.		1	
						



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
ROPE2-50G	Troy Barbell	50 ft Battle Rope 2 inch Diamter 	• Fray Resistant Material • Vinyl Grips • 37lbs.		1	
ALDB	Troy Barbell	Leather Dip Belt 			1	
GCB-28S	Troy Barbell	28in. Multi-Purpose Curl Bar with Swivel 			1	
GCT	Troy Barbell	Chinning Triangle 			1	
GLB-48	Troy Barbell	48in. Lat Bar 			1	



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Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
GTVB	Troy Barbell	Triceps Press Down V Bar			1	
						
GSB-20S	Troy Barbell	20in. Multi-Purpose Economy Straight Bar with Swivel			1	
						
VTR-36	Troy Barbell	Triceps Rope	• VTX Black Solid Rubber Bumper Plate • Solid steel insert		1	
						
MISC	Advanced Exercise	PRx - Wall Mounted Battle Rope Storage - PX281			2	
MISC	Advanced Exercise	PRx - Wall Mounted Mobility Band Storage - PXS014			2	



BAY EQUIPMENT

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
MISC	Advanced Exercise	PRx - 3x3 Profile Rack PRO with Multi-Grip Bar (96") - PXP400 - Red			1	
MISC	Advanced Exercise	PRx - 4-peg Plate Storage - PXS002 - Black			2	



advanced exercise

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
MISC	Advanced Exercise	PRx - Plate Storage Weight Wing Extension - PXS017 - Black			2	
MISC	Advanced Exercise	PRx - Single bar wall mounted storage - PXS015			1	
GO-002U	Troy Barbell	Urethane Encased Olympic Grip Plate 2.5lb. 			4	
GO-005U	Troy Barbell	Urethane Encased Olympic Plate 5lb. 			4	
GB0-010SBP	Troy Barbell	10 lb Rubber Bumper Plate 	• Solid Rubber Black Bumper Plate with Steel Insert • USA branded		4	
GB0-025SBP	Troy Barbell	25 lb Rubber Bumper Plate 	• Solid Rubber Black Bumper Plate with Steel Insert • USA branded		4	



advanced exercise

Model	Brand	Description	Specifications	Unit Price	Qty	Total Ext
GBO-045SBP	Troy Barbell	45 lb Rubber Bumper Plate 	• Solid Rubber Black Bumper Plate with Steel Insert • USA branded		8	
OB-20KG-190CR	UMAX	20KG 7ft Olympic Training Bar, 28MM, Cerakote Red 	• Center Knurling • Needle Bearings • 190,000 psi • 4 Year Warranty		1	

Comments:

Items specified through Sourcewell contracts
Life Fitness / Hammer - contract #081120-LFF
Octane - contract #081120-TRU

Equipment will be shipped, professionally assembled and delivered to site per floorpan.

Subtotal:

Freight, Delivery and Install:

Tax:

Total: