City and County of San Francisco
PORT OF SAN FRANCISCO

FISHERMAN'S WHARF FORWARD-TAYLOR STREET PUBLIC PLAZA

CONTRACT NO. 2894

PROJECT MANUAL

VOLUME 3 OF 3

10/2025

Each Bid shall be enclosed in an envelope bearing the description:
''BID FOR FISHERMAN'S WHARF FORWARD-TAYLOR STREET PUBLIC PLAZA
(Port of San Francisco Contract No. 2894)''.

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STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of buildings or structures.
2. Salvaging items for reuse by Owner.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

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

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review storage, protection, and accounting for items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For specialty demolition contractor.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Survey of Existing Conditions: Submit survey.

D. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Universal certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 40 working days' notice of activities that will affect operations of adjacent occupied buildings and tenants.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. It is not expected that hazardous materials will be encountered in the Work. Hazardous materials will be removed under a separate contract before start of Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

E. On-site sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged. Photograph or video conditions that might be misconstrued as damage caused by removal.
2. Photograph or video existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations or removal of items for salvage.

3.2 PREPARATION

A. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Protect adjacent buildings and facilities from damage due to demolition activities.

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

B. Existing Utilities to Remain: Maintain utility services to remain and protect against damage during demolition operations.

C. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
1. Contractor to request Owner for approval to arrange shut off utilities with utility companies. Do not shut off any utilities without approval from Owner.
2. If disconnection of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade at or outside the building or structure to be demolished and cap, valve, or plug and seal remaining portion of pipe or conduit in accordance with requirements of authorities having jurisdiction.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing by authorities having jurisdiction.

D. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 SALVAGE

A. Items on the exterior to be removed and salvaged are indicated on Drawings.

B. Comply with the following for salvaged items:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated buildings completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 12 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. For natural gas, existing gas line shall be first disconnected from the PG&E gas meter and then thoroughly purged with air or inert gas in accordance with California Plumbing Code Section 1213.6.1.2 requirements.
6. Sanitary waste/vent and storm drain lines shall be capped as indicated on the drawings.

7. Domestic water lines shall be capped as indicated on the drawings. Disconnect water main from water meter and cap meter outlet for future use.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Existing Utilities:

1. Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.
2. Demolish existing utilities and below-grade utility structures that are within 5 ft. outside footprint indicated for new construction. Abandon utilities outside this area.

3. Demolish and remove existing utilities and below-grade utility structures.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
1. Remove below-grade construction, including foundation walls, and footings completely. See structural drawings for demolition of existing elevator pit.

3.6 REPAIRS

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

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them.

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

B. Do not burn demolished materials.

3.8 CLEANING

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

1. Clean roadways of debris caused by debris transport.

END OF SECTION

SECTION 03 30 05

UNDERSLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Underslab vapor barrier.

B. Related Sections include:
   1. Section 03 31 00 "Cast-In-Place Concrete" for concrete building slabs.

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 302.2R: Guide for Concrete Slabs That Receive Moisture-Sensitive Flooring Materials.

B. ASTM International (American Society for Testing and Materials):
   1. ASTM D 882: Test Method for Tensile Properties of Thin Plastic Sheeting.
   2. ASTM D 1709: Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
   3. ASTM E 154: Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
   4. ASTM E 1643: Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   5. ASTM E 1745: Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   6. ASTM F 1249: Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.3 DEFINITIONS

A. Vapor Barrier: Membrane with perm rating of 0.01 or less.

1.4 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at Project site to review pertinent issues related to underslab vapor barrier including, but not limited to, the following:
   1. Substrate conditions.
   2. Requirements for protecting vapor barrier prior to pouring of concrete slab.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data for vapor barrier. Include tested physical and performance properties.

B. Samples for Verification: Submit 8-inch by 10-inch samples of vapor barrier sheeting.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: From a qualified testing agency indicating vapor barrier complies with specified performance requirements.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages or containers bearing brand name and identification of manufacturer or supplier.

B. Store materials out of direct exposure to the elements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with requirements of ACI 302.2R for underslab vapor barriers.

B. Water Vapor Permeance: Provide underslab vapor barrier with maximum water vapor permeance of 0.010 perm (maximum water vapor transmission rate: 0.0036 grains/sq ft/hr) when tested in accordance with ASTM F 1249, and after mandatory conditioning tests per ASTM E 154, Sections 8, 11, 12, and 13.

2.2 UNDERSLAB VAPOR BARRIER

A. Vapor Barrier: Polyolefin or high-density reinforced polyethylene with geo membrane film, conforming with requirements of ASTM E 1745, Class A, and the following minimum requirements:

1. Products: Subject to compliance with requirements, provide one of the following products:
    a. Henry; Moistop Ultra 15
    b. Equal product in accordance with Division 1 requirements for product substitutions
2. Thickness: 15 mils minimum.
3. Tensile Strength: 58 lbf per inch minimum when tested in accordance with ASTM D 882.
4. Puncture Resistance: 4900 grams minimum when tested in accordance with ASTM D 1709, Method B.

2.3 ACCESSORIES

A. Joint Sealers: Pressure sensitive tape or mastic as recommended by vapor barrier manufacturer for specific material and application indicated.

B. Adhesives: Types as recommended by vapor barrier manufacturer for specific material and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that gravel base (capillary break) has been installed, properly compacted, and is free from projections and irregularities that may be detrimental to installation of vapor retarder.

B. Verify that items passing through vapor barrier are properly and rigidly installed.

C. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install vapor barrier sheeting in accordance with ASTM E1643 and as amended by manufacturer's written instructions.

B. Start installation of underslab vapor barrier in presence of manufacturer's technical personnel.

C. Lay vapor barrier sheeting with longest direction parallel to concrete pour. Lay sheeting smooth and free from folds and bunches.

D. Lap vapor barrier sheeting over footings or seal to foundation walls.

E. Wrap vapor barrier sheeting up vertical surface of slab perimeter. Terminate three inches below finish grade.

F. Lap sheeting minimum 6 inches at seams; seal with tape or adhesive as recommended by manufacturer.

G. Seal vapor barrier sheeting around penetrations such as columns with tape. Seal around pipe and other similar penetrations with manufacturer's standard boot.

H. Inspect and repair membrane prior to application of finish material over membrane; tape tears, perforations and similar damage.

3.3 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to inspect underslab vapor barrier installation, including accessories. Report results in writing.

3.4 PROTECTION OF INSTALLED WORK

A. Take precautions necessary to protect vapor barrier sheeting during installation of reinforcing and concrete.

B. Ensure that only concrete brick type reinforcing bar supports are used, or that supports are placed on protective pads of asphaltic hardboard or other material recommended by vapor barrier sheeting manufacturer.

C. Ensure that no stakes are driven through vapor barrier sheeting.

D. Immediately prior to placing concrete reinforcing, inspect vapor barrier for tears, perforations and similar damage. Repair with tape.

END OF SECTION 03 30 05

SECTION 03 30 50

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place concrete, including formwork and reinforcement.
2. Preparation of existing concrete surfaces to receive new concrete.

B. Related Sections:
1. Division 07 Section for vapor retarder below wharf topping slab.

1.2 REFERNCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in ACI 301.

C. American Concrete Institute's:
1. ACI 301 – Specification for Structural Concrete for Buildings, 2016.
2. ACI 318 – Building Code Requirements for Structural Concrete, 2019

D. CBC – 2022 California Building Code

1.3 ACTION SUBMITTALS

A. Submittal procedures and administrative procedures are established by Division 01 Section "Submittal Procedures".

B. Manufacturer's product data for proprietary materials and items, including admixtures, finish materials, curing materials, and waterstops.

C. Mix designs for each concrete mixture, including mixture proportions and properties.
1. For Mix "A", mix design submittal shall include Environmental Product Declaration (EPD). If available, provide a product-specific Type III EPD – third party certified EPD including external verification in accordance with ISO 14025. Alternatively, submit an industry-wide (generic) EPD – products with third-party certified EPD including external verification in accordance with ISO 14025 in which the manufacturer is explicitly recognized as a participant by the program operator.

D. Shop drawings for reinforcing steel: Submit placing drawings prepared in accordance with ACI 315. Show size, shape and location of bars in structure.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates: Certify materials comply with specifications.
1. Cementitious materials.

2. Aggregates, including gradation
3. Reinforcing steel and accessories.

B. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM C94. Submit ticket to Testing Laboratory.

1.5 QUALITY ASSURANCE

A. Comply with applicable provisions of following codes and specifications, except where more stringent requirements are shown or specified:
1. ACI 301: Specifications for Structural Concrete for Buildings.
2. ACI 318: Building Code Requirements for Reinforced Concrete.

B. Concrete batch plant shall comply with the requirements of ASTM C94, Section 10, as certified by the National Ready Mixed Concrete Association.

C. If the test results of aggregates for potential reactivity (ASTM C289) are other than innocuous, concrete mixtures shall be tested in accordance with ASTM C1567. Tests shall indicate an expansion of less than 0.10 percent at 16 days of age.

PART 2 - PRODUCTS

2.1 FORMWORK

A. General: Comply with ACI 302, Section 2. Products shall be suitable to obtain type of finish specified.

B. Plywood Form-facing Material: PS1, exterior-type plywood manufactured for concrete forming; edge sealed. Acceptable products: Type B-B Plyform, MDO-Concrete Form, or HDO-Concrete Form.

C. Form Release Agents: Commercial formulation compounds, that will not bond with or stain concrete surfaces and will not impair bonding of paint or other coatings intended for use.

D. Expansion Joint Filler:
1. Foam-Type: Closed cell foam. ASTM D5249, Type 2, and ASTM D1752, Sections 5.1 to 5.4 at 10% minimum to 25% maximum compression, 3/4 inch thick where not otherwise designated.
2. Fiber-Type: Preformed asphalt impregnated fiber, ASTM D1751, 3/4 inch thick where not otherwise designated.

E. Expansion Joint Sealant: Conform to Division 07 Section "Joint Sealants". Sealant used at floors shall be traffic grade, except where joint abuts a wall, column or other vertical surface.

2.2 REINFORCEMENT

A. Bars: ASTM A615 or A706, deformed; Grade 60, except where otherwise designated on Drawings.

B. Bar Supports: Conform to requirements of CRSI "Manual of Standard Practice". Precast concrete supports shall be permitted on ground or atop vapor retarder.

C. Shop fabricate reinforcing steel to standard tolerances of ACI 315.

2.3 CONCRETE MATERIALS

A. Cementitious Materials:
   1. Cement Free: ASTM C595 and C1157 cements.
      a. C-Crete, or approved equal.
   2. Conventional Mix: Combination of Portland cement and supplementary cementitious materials; subject to limitations specified herein.
      a. Portland cement: ASTM C150, Type II, or V, low alkali.
      b. Fly ash: ASTM C618, Class F.
      c. Slag cement: ASTM C989, Grade 100 or 120.

B. Coarse Aggregates: ASTM C33, Size 67 except as otherwise specified or approved.
   1. Aggregate for Shrinkage Controlled Concrete: Orca (as supplied by Cemex), or approved equal. Do not blend pea gravel with shrinkage-controlled aggregates.

C. Fine Aggregates: ASTM C33.

D. Water: Potable.

E. Admixtures: Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Acceptable Manufactures: BASF Construction Chemicals, W.R. Grace and Co., or Euclid Chemical Co.
   1. General: Admixtures containing more than 0.05% chloride ions are not permitted.
   2. Air-entraining: ASTM C260. Total air shall not exceed 3% by volume when entrained air is not specified.
   3. Water-reducing: ASTM C494, Type A.
   4. Set-retarding: ASTM C494, Type B. Provide in necessary dosage to achieve desired set time.
   5. Set-accelerating: ASTM C494, Type C, non-chloride. Provide in necessary dosage to achieve desired set time.
   6. Mid-range Water-reducing: ASTM C494, Type A/F, polycarboxylate formulation designed to minimize shrinkage. Provide in manufacturer's recommended (mid-range) dosage where specified to increase slump to facilitate pumping and/or placement.

F. Cementitious Underwater Grout: Cohesive, non-segregating, non-metalic, high strength grout designed with anti-washout admixture, corrosion inhibitors and polymers:
   1. Simpson FX-225 Non-shrink Cementitious Underwater Grout
   2. Five Star Marine Cementitious Underwater High-Strength Pile Grout
   3. Or equal as approved by the structural engineer of record.

G. Marine Epoxy Grout: 100% solids, three-component, moisture insensitive epoxy grout:
   1. Simpson FX-70-6MP multi-purpose marine epoxy grout
   2. Five Star Marine High Flow Pile Jacket Epoxy Grout LPL-HF.
   3. Or equal as approved by the structural engineer of record.

H. Top Seal Epoxy: 100% Solids, two component, non sag, low modulus moisture insensitive epoxy adhesive:
   1. FX-763 trowel-grade epoxy mixed with FX-702 silica filler
   2. Five Star Marine Splash Zone
   3. Or equal as approved by the structural engineer of record.

2.4 RELATED MATERIALS

A. Moisture-retaining Cover (for curing):

1. Waterproof Paper: Asphalt laminated, reinforced wet strength kraft paper; conforming to ASTM C171. Acceptable Products: Orange Label Sisalkraft® by Fortifiber, or equal.
2. Laminated Polyethylene Burlap: 4 mil white opaque polyethylene laminated to 10 oz. burlap or nonwoven polypropelene fabric; conforming to ASTM C171, Type 1.1.3. Acceptable products: Curlap™ by Midwest Canvas Corp, Transguard™ 4000 by Raven Industries, or equal.

B. Curing Compound: Dissipating resin type, conforming to ASTM C309, Type 1, Class B, with a VOC less than 100 g/L. Acceptable products: 1100-Clear by WR Meadows, Kurez DR-100 by Euclid Chemical Co., or approved equal.

C. Corrosion Resistant Paint:
1. MC-Tar 100, by Wasser Corp.
2. Typoxy Series 27 W8, by Tnemec

2.5 CONCRETE MIX REQUIREMENTS

A. Mix "A" (for topping slab and slab on grade):
1. Compressive Strength: 4,000 psi at 28 days (ASTM C39).
2. Slump: 6 inches, plus or minus 1-inch tolerance (ASTM C143).
3. Cementitious Material: Cement Free, coordinate color of mix with landscape architect
4. Aggregate: Size 67 (3/4-inch) from specified source for Shrinkage Controlled Concrete.
5. Water Content: Limit total water to 275 pounds per cubic yard.
6. Water-to-Cementitious Material Ratio: Limit to 0.45 by weight.
7. Admixtures: Provide mid-range, water-reducing admixture at necessary dosage to provide adequate slump and workability at specified water content.
8. Maximum GWP: 162 lb CO_2e/yd^3

B. Mix "B" (for foundations):
1. Compressive Strength: 4,000 psi at 28 days (ASTM C39).
2. Slump: 6 inches, plus or minus 1-inch tolerance (ASTM C143).
3. Cementitious Material: Conventional Mix of Portland cement, fly ash or slag cement.
4. Aggregate: Size 67 (3/4-inch) from specified source for Shrinkage Controlled Concrete.
5. Water Content: Limit total water to 275 pounds per cubic yard.
6. Water-to-Cementitious Material Ratio: Limit to 0.45 by weight.
7. Admixtures: Provide mid-range, water-reducing admixture at necessary dosage to provide adequate slump and workability at specified water content.
8. Maximum GWP: 414 lb CO_2e/yd^3

2.6 PROPORTIONING

A. Contractor shall determine the mix proportions for concrete in conformance with these specifications.

B. Proportion mixes in accordance with ACI 318, on the basis of field experience or trial batches.

C. Proposed mixes shall produce concrete to strength specified with adequate workability and proper consistency to permit concrete to be conveyed by pumping and worked into forms and around reinforcement without excessive segregation or bleeding.

2.7 CONCRETE MEASURING AND MIXING

A. Measure, batch, mix, and deliver concrete according to ASTM C 94.

1. When air temperature exceeds 85 deg F, reduce mixing and delivery time from 1-1/2 hours to 60 minutes.

B. After initial batching, additions shall be limited to water.
   1. Additions shall be made using suitable calibrated devices.
   2. Water additions shall not exceed water-to-cementitious ratio requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation for Bonding to Existing Concrete
   1. Remove waterproofing materials, dirt, debris and unsound concrete.
   2. Prepare surface mechanically using equipment that will expose the coarse aggregate and give a surface profile of 1/8-inch minimum. Remove all residue and loosened aggregates from surface.
   3. Clean surfaces of dust and debris using a water jet followed by compressed air. Surfaces shall be damp, but shall not be so wet as to overcome suction.

B. Construction Joint Preparation
   1. Horizontal joints: Remove entire surface to expose clean aggregate solidly embedded in mortar matrix to full 1/4-inch amplitude. Do not leave laitance, loosened particles of aggregate or debris at surface.

C. Preparation for Slab-On-Ground or Topping Slab Construction
   1. Place underslab vapor retarder where required in accordance with requirements of Division 7 sections of these specifications and recommendations of ASTM E 1643. .
   2. Do not place concrete until Owner's Representative has observed vapor retarder and damaged areas have been repaired.

3.2 FORMWORK

A. Provide, erect, support, brace and maintain formwork and shoring to safely support loads caused by concrete placement and other loads that might be applied, until such loads can be supported by hardened concrete in the completed structure. Conform to ACI 347.

B. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, level and plumb work in finished structure. Finished work shall conform to tolerances of ACI 117, including tolerances of offsets at panel edges.

C. Select form facing materials to obtain required finishes; conform to ACI 301. Solidly butt and back joints to prevent leakage of cement paste.

D. Form Release Agent: Apply a coating of form release agent immediately prior to installation of reinforcing steel and embedded items. Do not allow release agent to puddle on forms or concrete.

E. Provision for Other Trades: Provide openings in formwork and sleeves to accommodate work of other trades. Determine size and location of openings and recesses from trades requiring them. Obtain approval of Owner's Representative for openings not shown on structural drawings.

F. Expansion Joints: Provide expansion joints and isolation joints where designated on Contract Documents.
   1. Use fiber filler at building exterior, except where joints are to be sealed.

2. Use foam type joint filler at all interior joints and at sealed joints at building exterior. Hold edge back as required for sealant application in accordance with sealant manufacturer's recommendations.

G. Embedded Items: Accurately place and securely support anchorage devices and other embedded items required for other work that is attached to cast in place concrete.

H. Removal: Do not remove forms and shores until concrete has hardened and attained sufficient strength to permit safe removal and adequate support of inherent and imposed loads.

I. Reuse of forms shall be acceptable provided that surfaces are in good condition and free of injurious materials. Reuse of formwork that would reduce quality of exposed-to-view concrete shall not be permitted.

3.3 REINFORCEMENT

A. Fabricate, place and support reinforcement in accordance with ACI 301 and CRSI’s “Manual of Standard Practice”.

B. Support and securely tie reinforcing to prevent displacement during concrete placement.

C. Maintain minimum coverage as indicated for concrete protection.

3.4 PLACING CONCRETE

A. Examine units of work to be cast and verify that:
1. Construction of formwork is complete.
2. Required reinforcement, inserts, and embedded items are in place and securely held.
3. Concrete-receiving places are free of debris and excess water.

B. Protect finished surfaces adjacent to concrete-receiving places.

C. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent segregation.

D. Consolidate all concrete using internal vibrators in accordance with ACI 309.

3.5 FINISHES FOR SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces.

B. Slab Finishes: Refer to ACI 301 for each finish type.

C. Slab Finish Schedule: All floors shall receive a steel trowel finish, unless noted otherwise. Refer to Article 3.12, "Finish Schedule" for other finish types and locations.

3.6 FINISHES FOR FORMED SURFACES

A. General: Perform subsequent finishing operations as soon as practical after stripping formwork, except as specifically noted.

B. Surface Finishes: Refer to ACI 301 for requirements for each finish type—1.0 (Rough-formed), 2.0 (Smooth-formed) and 3.0 (As-cast exposed to view).

C. Formed Finish Schedule: All formed surfaces shall receive a “2.0 (Smooth-formed)” finish, unless noted otherwise. Refer to Article 3.12, "Finish Schedule" for other finish types and locations.

3.7 CURING AND PROTECTION

A. General: Start initial curing as soon as free water has disappeared from concrete following finishing. Keep concrete continuously moist for 7 days minimum after placement.
   1. Subject to approval of Owner's Representative, application of curing compound may be delayed when specialty compound for moisture vapor emission is used for curing, usually 4 to 24 hours. Slab shall be carefully monitored for moisture content at the surface and compound shall be applied prior to evaporation rate exceeding moisture emission rate.

B. Curing methods:
   1. Moisture-retaining cover curing: As soon as concrete is sufficiently set to permit application without marring surface, unroll cover over the entire area, laid smooth without folds or bunches of material. Lay blanket in accordance with manufacturer’s instructions, overlapping edges a minimum of 6 inches and extending ends 12 inches beyond area of concrete to be cured. Immediately repair holes or tears that occur within first 5 days using sheeting material and waterproof tape. Maintain cover in place for 7 days.
   2. Compound curing: Apply specified curing compound as soon as final finishing operations are complete. Uniformly apply two coats of compound in a continuous operation with second coat at right angles to first. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Recoat concrete surfaces subjected to rainfall within 3 hours after the curing compound application. Maintain compound on the concrete surface throughout the curing period and immediately repair any damage.

C. Hot weather requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods; use reflective cover.

3.8 SAW-CUT JOINTS

A. Construct contraction joints in slabs-on-grade and topping slab using saw cuts 1/8 inch wide by 1-inch deep. Make cuts using early-entry equipment as soon as possible following finishing, usually 4 hours.

B. Perform all cuts cleanly and smoothly to a constant and equal depth in as continuous an operation as possible to avoid misalignment of joints. Use only experienced personnel and forms or templates as required to achieve consistent lines.

3.9 CLEANING, PATCHING AND DEFECTIVE WORK

A. Cleaning: Remove curing compounds, form release agents and other materials employed in concrete work that prevent proper application of finishes, sealants, or other treatments. Use positive method, as recommended by manufacturer, to achieve complete removal.

B. Repair of formed surfaces: Immediately after form removal, cut out honeycombs, rock pockets, and voids. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat surface of void with neat cement paste. Immediately fill and compact with patching mortar.

3.10 GROUTING BASEPLATES

A. Grouting baseplates and bearing plates: Prior to installation, clean and roughen concrete surface beneath baseplate; clean bottom surface of baseplate of bond-reducing materials. After steel elements have been positioned and plumbed, flow nonshrink grout solidly between bearing surfaces to ensure no voids remain. Comply with manufacturer's recommendations for mixing, placing, finishing and curing of grout.

3.11 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section "Quality Requirements".

B. Testing Laboratory will:
1. Collect and review tickets for each batch of concrete delivered. Annotate water added subsequent to batching.
2. Special Inspect:
   a. Placement of reinforcement for conformance with the Contract Documents, as required by CBC Table 1705.3.
   b. Concrete placement, as required by CBC Table 1704.3, for conformance with the Contract Documents.
3. Sample and test for:
   a. Compressive strength: One sample at the start of each days placement and for every 50 cubic yards thereafter. A sample shall be the average of two 6 by 12 inch cylinders or three 4 by 8 inch cylinders. Cylinders shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39 at 28 days.
   b. Slump: ASTM C 143; one test at start of placement and every two hours thereafter.
   c. Temperature: ASTM C 1064; one test every two hours during hot weather. Make additional tests when warranted by delays in delivery.

C. The Contractor shall pay Testing Laboratory for investigating of low-strength compressive test results in accordance with ACI 318, Section 5.6.5, except where results of test cylinders are not representative of in-place concrete.

3.12 FINISH SCHEDULE

A. The concrete finish types specified in "Table 1 - Finishes for Slab Surfaces" and "Table 2 - Finishes for Formed Surfaces", shall be used except as otherwise designated on drawings.

B. Exposed surfaces that are scheduled to receive paint or other thin finish coatings shall be considered "Exposed-to-View".

TABLE 1: FINISHES FOR SLAB SURFACES

Surface	Finish	Tolerances	Curing
Floor, U.O.N.	Trowel	Moderately Flat	Compound

TABLE 2: FINISHES FOR FORMED SURFACES		
Surface	Finish	Notes
Typical, except as otherwise noted.	SF-2.0	

END OF SECTION

SECTION 03 61 00

POST-INSTALLED REINFORCING BARS IN CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcing bars installed in hardened concrete using adhesive prepackaged in cartridges.

B. Related Sections:
1. Section 05 05 25 – Post-Installed Concrete Anchors for installation of threaded rods using adhesive for attachment of nonstructural and structural components.

1.2 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in ACI 301.

C. CBC – 2022 California Building Code

D. ICC Evaluation Service (ICC-ES)
1. AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements, 2015.

1.3 SUBMITTALS

A. Submittal procedures and administrative procedures are established by Division 01 Section "Submittal Procedures".

B. Product data for proprietary materials, including epoxy adhesive. Include manufacturer's detailed instructions for storage and handling, installation, and special inspection.
1. Include current ICC Evaluation Service Report.

1.4 QUALITY ASSURANCE

A. Cartridge Adhesive: Products proposed for use shall have an active ICC Evaluation Service Report evidencing compliance with ICC ES acceptance criteria AC308 for use to resist tension and shear in cracked and uncracked concrete.
1. Installation shall conform to manufacturer's written instructions listed in ICC ES report.

B. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
1. Hole drilling procedure
2. Hole preparation & cleaning technique

3. Adhesive injection technique & dispenser training / maintenance
4. Reinforcing bar preparation and installation

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Store adhesive cartridges in accordance with manufacturer's recommendations, including exposure to temperature and sunlight.

PART 2 - PRODUCTS

2.1 ADHESIVE

A. Cartridge Adhesive: Two-component, 100% solids, structural epoxy conforming to ASTM C881, Type IV; Grade 3; prepackaged in cartridges for manually or pneumatically operated caulk gun and automatically mixed at nozzle. Approved for use in cracked and uncracked concrete in accordance with ICC ES AC308, as demonstrated by an active ICC Evaluation Service Report. Subject to compliance with specified requirements, provide one of the following, or equal:

HIT-RE 500-V3 Adhesive, Hilti Inc.
Set-XP Epoxy Adhesive, Simpson Strong-Tie Co.
Pure 110+, Dewalt\Powers

2.2 REINFORCING BARS

A. Reinforcing Bars: ASTM A615, Grade 60, or ASTM A706, deformed; except as otherwise noted on Drawings. Embedded end shall be free of offsets that interfere with installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas to be drilled to verify conditions of access, interferences, and existing materials.

B. Locate reinforcing steel and other embedded items, which might interfere with drilling. Take particular care to locate prestressing steel and embedded conduits, where presence is expected.

C. Protect existing exposed surfaces from grouting operations.

D. Bars shall be free of oil, mud, loose rust or other materials that may reduce bond.

E. Do not drill holes until concrete has achieved full design strength.

3.2 INSTALLATION

A. General: Install in accordance with manufacturer's written instructions, including drilling, hole cleaning, dispensing of epoxy and setting of reinforcing bars.
1. Observe manufacturer recommendations with respect to installation temperatures.

B. Drilling Equipment: Drill holes with electric or pneumatic rotary type drilling hammer using carbide-tipped bits. Drill bits shall be of diameters as specified by the cartridge adhesive manufacturer for each reinforcing bar size.

1. Hollow carbide tipped hammer drill bits, as recommended by manufacturer, shall be permitted.
2. Core drilling shall not be permitted, except with prior approval of Owner’s Representative and approved hole roughening.

C. Drilling:
1. Drill holes to depth designated on drawings and perpendicular to the concrete surface, unless specifically shown otherwise.
2. Where hole is located closer than 2 hole diameters to concrete surface, use lighter impact.
3. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items.
   a. Where reinforcing is encountered, abandon hole and drill new hole a minimum of 2 diameters clear at no additional cost to Owner.
   b. Notify the Owner’s Representative if other embedded items are encountered during drilling.

D. Cleaning: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive.

E. Installation:
1. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
2. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface.
3. At overhead applications, use manufacturers standard hole plug to prevent epoxy leakage and temporarily support dowel to prevent movement out of hole.
4. Remove excess adhesive from the surface before it hardens on surfaces that will not be exposed to view. Shim anchors with suitable device to center the anchor in the hole.
5. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

3.3 PROTECTION

A. Protect dowels from accidental disturbance during setting time specified by manufacturer.

B. Do not place pull-out or shear loads on dowels during curing time specified by manufacturer.

3.4 CLEANING

A. On surfaces that will be exposed to view, allow epoxy to cure then chip away hardened epoxy. Surfaces shall be repaired to match existing finish to the satisfaction of the Owner's Representative.

3.5 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section, "Quality".

B. Testing Laboratory will:
1. Review manufacturer's recommended installation and inspection procedures, as contained in ICC Evaluation Service Report.

2. Special Inspect installation for conformance with Contract Documents, manufacturer's recommendations, and requirements of the applicable ICC-ES report.
3. Proof test a random sample of dowels in accordance with the following requirements, except where Drawings designate that no proof testing is required.
   a. Frequency: Two test dowels shall be randomly selected by Testing Laboratory from each group for each day’s placement. A group shall consist of dowels of the same size, embedment and orientation, and installed by the same personnel.
   b. Testing Procedure: Hydraulic ram tension testing for bond, confined configuration; in accordance with ICC-ES AC308. Testing shall be performed following wait period recommended by adhesive manufacturer.
   c. Test Load: As designated on Drawings.
   d. Acceptance Criteria: No discernible movement of dowel out of hole while maintaining the test load for 15 seconds minimum.
   e. Failure of one dowel shall constitute rejection of that group of dowels until additional testing is performed and accepted by the Owner's Representative. The testing frequency for group shall be increased to 25 percent, but not less than five dowels. In the event of additional failures, the Group shall be rejected and the cause of failure shall be investigated.

END OF SECTION

SECTION 05 05 25

POST-INSTALLED CONCRETE ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Post-installed mechanical anchors in concrete, including:
      a. Wedge-type expansion anchors approved for use for seismic applications in cracked and uncracked concrete.
      b. Screw-type drilled-in anchors in concrete, approved for use for seismic applications in cracked and uncracked concrete.
      c. Post-installed adhesive anchors in concrete, approved for use for seismic applications in cracked and uncracked concrete.

1.2 REFERENCES

A. ICC-ES or IAPMO-ES Evaluation Report: Evaluation Report issued by the ICC or IAPMO Evaluation Service demonstrating compliance with provisions of the 2015 International Building Code.

1.3 DEFINITIONS

A. Nominal Embedment Depth: Minimum length from concrete surface to end of anchor following completion of anchor installation. For wedge-type anchors, nominal embedment depth shall be measured following application of installation torque.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01, "Submittal Procedures".
   1. Manufacturer's product data.
   2. Manufacturer's installation instructions.
   3. ICC-ES or IAPMO-ES Evaluation Reports.

1.5 QUALITY ASSURANCE

A. Certifications: Anchors shall have an active ICC-ES or IAPMO-ES Evaluation Report in accordance with the following ICC-ES Acceptance Criteria:
   1. Mechanicals Anchors in Concrete: Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC 193).
   2. Adhesive Anchors in Concrete: Acceptance Criteria for Post-installed Adhesive Anchors in Concrete Elements (AC 308)

PART 2 - PRODUCTS

2.1 MECHANICAL ANCHORS

A. General: Anchors shall be tested and approved for use in cracked and uncracked concrete in accordance with ICC-ES AC 193.

1. Anchors installed through underside of steel deck shall be tested and approved for installation through the soffit of concrete filled metal deck assemblies in accordance with ICC-ES AC 193.

B. Acceptable Products: Where anchor manufacturer and product are indicated on Drawings, provide designated product.
   1. Contractor shall be allowed to substitute products of other manufacturer's, subject to demonstrating equivalent tension and shear strength to specified anchor, under project installation conditions.
   2. Where anchor design is prepared by Trade Subcontractor's Engineer, use product designated by Trade Subcontractor's Engineer, subject to meeting requirements of this Section.

C. Wedge Anchors: Wedge type, torque-controlled expansion anchors. Size and nominal embedment depth as indicated on Drawings.
   1. Material: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, SC1, Type III. Where indicated on the Drawings, provide AISI Type 304 or Type 316 stainless steel anchors with manufacturers matching nut and washer.
   2. Acceptable Products: Where anchor product and manufacturer are not indicated on Drawings or designated by Trade Subcontractor's Engineer, provide one of the following:
      a. Kwik Bolt TZ2, by Hilti, Inc.
      b. Strong-bolt, by Simpson Strong-Tie Co.
      c. Power-Stud+ SD2, by Dewalt\Powers.
      d. Trubolt+ Wedge Anchor, by ITW Red Head.

D. Screw Anchors: Hardened steel, screw-type anchors or rod hangers approved for use in cracked and uncracked concrete. Diameter and nominal embedment depth as indicated on Drawings.
   1. Limitations: Anchors shall be used in dry interior environments only.
   2. Material: Case hardened low carbon steel, with zinc plating in accordance with ASTM B633, SC1, Type III.
   3. Acceptable Products: Where anchor product and manufacturer are not indicated on Drawings or designated by Trade Subcontractor's Engineer, provide one of the following:
      a. Kwik HUS-EZ screw anchor and HUS-EZ1 rod hanger, by Hilti, Inc.
      b. Titen HD Screw Anchor and Titen HD Rod hanger, by Simpson Strong-Tie Co.
      c. Wedge-Bolt+, Vertigo+ Rod Hanger, and Snake+ screw anchor by Powers Fasteners.

2.2 ADHESIVE ANCHORS

A. Adhesive Anchors: Threaded steel rod or inserts complete with nuts and washers, epoxy adhesive injection system, and manufacturer's installation instructions.

B. General: Anchors shall be tested and approved for use to resist seismic forces (IBC Seismic Design Categories A to F) in cracked and uncracked concrete in accordance with ICC-ES AC 308.

C. Epoxy Adhesive: Two-component, 100% solids, structural epoxy conforming to ASTM C881, Type IV; Grade 3; prepackaged in cartridges for manually or pneumatically operated caulk gun and automatically mixed at nozzle.
   1. Where anchor manufacturer and product are indicated on Drawings, provide designated product.
   2. Contractor shall be allowed to substitute products of other manufacturer's, subject to demonstrating equivalent tension and shear strength to specified anchor, under project installation conditions.

3. Where anchor design is prepared by Trade Subcontractor’s Engineer, use product designated by Trade Subcontractor’s Engineer, subject to meeting requirements of this Section.
4. Acceptable Products: Where anchor product and manufacturer are not indicated on Drawings or designated by Trade Subcontractor’s Engineer, provide one of the following:
   a. HIT RE500 V3 Epoxy Adhesive Anchoring System, by Hilti, In.
   b. Set-XP Epoxy Adhesive, by Simpson Strong-Tie Co.
   c. Pure 110+, by Dewalt\Powers.
   d. Epcon G5 adhesive, by ITW Red Head.

D. Acrylic Adhesive: Hybrid Adhesive: Two-component, hybrid adhesive prepackaged in cartridges for manually or pneumatically operated caulk gun and automatically mixed at nozzle. Approved for use in cracked and uncracked concrete in accordance with ICC ES AC308 or ACI 355.4, as demonstrated by an active ICC or IAPMO Evaluation Service Report.
1. Acceptable Products: Where anchor product and manufacturer are not indicated on Drawings or designated by Trade Subcontractor’s Engineer, provide one of the following:
   a. HIT-HY 200 Adhesive, Hilti Inc.
   b. AT-XP Adhesive, Simpson Strong-Tie Co.
   c. AC100+ Gold, Powers Fasteners

E. Threaded Rod:
1. Material: Unless otherwise indicated on the Drawings, furnish carbon steel threaded rods conforming to ASTM A36 or ASTM A193 Type B7. As indicated on the Drawings, provide Type 304 or Type 316 stainless steel anchors with manufacturers matching nut and washer.
2. Finish: Furnish carbon steel rods with zinc plating in accordance with ASTM B633, SC1, Type III at dry interior locations. Furnish carbon steel rods with hot-dipped galvanized coating complying with ASTM A153 at exterior and damp interior locations.

PART 3 - EXECUTION

3.1 GENERAL

A. Install anchors in conformance with manufacturer's written instructions.

B. Examination:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Notify Owner's Representative for clarification where reinforcing steel or other embedded items require relocation of anchors or cutting of reinforcement.
2. Notify Owner's Representative for clarification where anchors appear to be located too close to edge of concrete, in particular where edge is not shown on Drawing detail.
3. Notify Owner's Representative for clarification where concrete thickness is inadequate to achieve specified anchor embedment. Minimum concrete thickness shall allow for specified embedment, plus one anchor diameter allowance for overdrilling, plus 3/4 inch minimum cover from end of hole to concrete surface.

C. Drilling:
1. Do not drill holes in concrete mix has achieved full design strength.
2. Drill holes with rotary impact hammer drills using carbide-tipped bits with diameter as recommended by anchor manufacturer. Reduce impact as hole approaches concrete surface as necessary to prevent cracking and spalling. Use core bits only with approval of Owner's Representative and only for mechanical anchors.
3. Holes shall be drilled perpendicular to the concrete surface, unless otherwise shown on Drawings. Anchors shall be drilled to within 5 percent of specified alignment.

4. Exercise care in drilling to avoid damaging existing reinforcing, conduits and other embedded items.

3.2 WEDGE ANCHORS

A. Drill holes designated nominal embedment depth plus one anchor diameter minimum. End of hole shall be 3/4 inch minimum clear from concrete surface.

B. Remove dust and debris with pressurized air, in accordance with manufacturer's instructions.

C. Set anchors to designated nominal embedment depth, plus an allowance for withdrawal during torque tightening.

D. Tighten using a torque wrench to manufacturer's recommended installation torque. Following attainment of 10% of recommended torque, achieve 100% of designated torque within 5 or fewer turns of the nut. If torque is not achieved, the anchor shall be removed and replaced unless otherwise directed by the Owner's Representative.

3.3 SCREW ANCHORS

A. Take particular care to achieve proper hole diameter. Use only sharp bits with diameter recommended by manufacturer. Use drilling equipment and methods to prevent enlargement of holes by wobble.

B. Remove dust and debris with pressurized air, in accordance with manufacturer's instructions.

C. Install the anchor in accordance with manufacturer's instructions with an impact wrench. Take care not to overtighten anchor; note that manufacturer's maximum installation torque is not the torque intended to be achieved during proper installation.

3.4 ADHESIVE ANCHORS

A. Drill holes to diameter recommended by manufacturer with rotary impact hammer drills using carbide-tipped bits; core bits shall not be permitted.

B. Thoroughly clean holes by brushing and blowing with compressed air in accordance with manufacturer's instructions. Clean immediately prior to anchor installation under observation of Special Inspector.

C. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole.

D. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

3.5 REPAIR OF DEFECTIVE WORK

A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.6 FIELD QUALITY CONTROL

A. Testing Laboratory will:
   1. Review manufacturer's recommended installation and inspection procedures, as contained in Evaluation Service Report.
   2. Special Inspect installation for conformance with Contract Documents, manufacturer's recommendations, and requirements of the applicable ES report. Verify that anchors are being installed by trained installers.
   3. Periodically inspect installation of mechanical anchors.
   4. Continuously inspect installation of adhesive anchors during hole cleaning and anchor installation.
   5. Proof test a random sample of dowels in accordance with the following requirements, except where Drawings designate that no proof testing is required.
      a. Wedge Anchors: Torque test 10% of anchors to recommended installation torque using a calibrated wrench. Anchor should not rotate more than 1/2 turn.
      b. Adhesive Anchors: Tension test a minimum of two anchors of each type for each installer for each day’s placement. Use hydraulic ram testing for bond, confined configuration. There shall be no discernible movement of anchor from hole after 15 seconds of loading. Test to loads shown on Drawings or as indicated by Owner's Representative.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Structural steel.
   2. Grouting of steel baseplates and bearing plates.

1.2 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. The year of adoption cited in AISC 360 or AISC 341 shall apply.

C. American Institute of Steel Construction's
   1. ANSI/AISC 303-16: Code of Standard Practice for Steel Buildings and Bridges
   2. ANSI/AISC 360-16: Specification for Structural Steel Buildings

D. American Welding Society's
   1. AWS D1.1: 2020: Structural Welding Code - Steel

E. CBC: 2022 California Building Code.

F. Research Council on Structural Connections'
   1. RCSC Specification: Specification for Structural Joints Using High Strength Bolts, 2020

G. SSPC: Latest edition of Society for Protective Coatings surface preparation and painting specifications apply where cited in this Section.

1.3 ACTION SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittal Procedures".

B. Requirements of "Submittals" supersede provisions of ANSI/AISC 303.

C. Shop drawings: Show complete information necessary for the fabrication and erection of structural-steel components in accordance with ANSI/AISC 360.
   1. Identify surface preparation and finish.

D. Product data for each type of product indicated, including but not limited to weld filler materials and shop primer paint.

1.4 INFORMATION SUBMITTALS

A. Mill test reports for steel.

B. Certificates of compliance that manufactured products meet or exceed specified requirements:
   1. Bolts, nuts and washers
   2. Welding filler materials, fluxes and shielding gases
   3. Paint

C. Welder Performance Qualification Records (WPQR’s)

D. Welding Procedure Specification (WPS) for each different welded joint proposed for use, whether prequalified or qualified by testing.
   1. Prepare in accordance with AWS D1.1 requirements.
   2. Include procedure qualification record (PQR) for procedures qualified by testing.

E. Samples: As requested by the Testing Laboratory.

1.5 QUALITY ASSURANCE

A. Comply with applicable provisions of AISC 303 and ANSI/AISC 360, except where more stringent requirements are shown or specified.

B. Qualifications for welding work: Qualify welding procedures and welding operators in accordance with AWS D1.1.

1.6 COORDINATION

A. Provide templates and setting drawings for installation of anchorage items embedded in other work.

B. Furnish embedded anchorage items to avoid delays to other Work.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. General:
   1. All steel shall be identified as required by ANSI/AISC 360.

B. Channels and angles: ASTM A 36; except ASTM A 572, Grade 50 may be substituted at Fabricator's option.
   1. Furnish members conforming to ASTM A 572, Grade 50 where designated on drawings.

C. Plates: ASTM A 572, Grade 50, or approved equal.

D. Pipes: ASTM A53, Type E, Grade B.

E. Structural tubing: ASTM A500, Grade B.

2.2 BOLTS, ANCHORS AND CONNECTORS

A. ASTM A307 bolts: ASTM A307, Grade A, hex headed bolts furnished with ASTM A563, Grade A, hex nuts.

B. Anchor rods (bolts): ASTM F1554, Grade 36.
   1. Head: Form head at embedded end with ASTM A563, Grade A, heavy hex nut. Interrupt threads to lock nut against loosening.

a. Hex head bolts conforming to ASTM A307, Grade A, shall be acceptable for anchor bolts that are 3/4 inch, or less, in diameter.

2. Plate washers (atop baseplate): ASTM A36. Square or round; minimum washer dimension shall be bolt diameter plus 2 inches and minimum thickness shall be 1/3 of bolt diameter.
   a. Standard washers (ASTM F844) shall be acceptable for 3/4 inch diameter and smaller bolts with 5/16 inch maximum oversize holes.
3. Nuts: ASTM A563, Grade A, heavy hex.
   a. Hex nuts shall be acceptable for anchor bolts that are 3/4-inch or less diameter.

C. Welding Consumables: Filler materials and fluxes shall conform to requirements of AWS D1.1; of suitable type for base metals being welded and the intended application.

2.3 OTHER ITEMS

A. Primer Paint: Fast-drying, rust-inhibitive, chromate- and lead-free modified alkyd primer. Acceptable Products: Series 10 by Tnemec, 42 Series by Maclac, or approved equal.

B. Galvanizing Repair Paint: ASTM A780.

C. Nonshrink grout: Premixed, nonmetallic, noncorrosive product, conforming to ASTM C 1107. Construction grout shall be permitted where least dimension of baseplate or bearing plate is less than 12 inches; otherwise grout shall have a set time of 30 minutes minimum at flowable consistency. Acceptable products: Masterflow® 555 by BASF, Five Star® Grout by Five Star Products, Inc., or approved equal.

2.4 FABRICATION

A. Fabricate structural steel in accordance with ANSI/ AISC 303 and ANSI/ AISC 360.
1. Conform to additional requirements of Division 05 Section "Architecturally Exposed Structural Steel" for AESS members and connections.

2. Thermal cutting: Make cuts by machine or using mechanical guide.

B. Welding
1. Weld in accordance with ANSI/AISC 360 and AWS D1.1.
2. Weld in accordance with welding procedure specifications (WPS's) for joint, which are to be available to welders and inspectors during the production process.
3. Groove welds shall be complete joint penetration welds, unless designated otherwise on drawings. Groove preparation is at Contractor's option, subject to qualification in accordance with AWS D1.1.
4. Partial penetration welds shall have an effective throat thickness as designated on drawings. Groove preparation is at Contractor's option, subject to qualification in accordance with AWS D1.1.

2.5 FINISHES

A. General:
1. Cleaning: All steel shall be free of oil and grease. Clean as required in accordance with SSPC SP1 "Solvent Cleaning".
2. Preparation: All steel shall be free of loose mill scale and foreign matter. Clean as required by SSPC SP 2 "Hand Tool Cleaning".

B. Do not prime paint the following steel surfaces
1. Surfaces in contact with concrete, except initial two inches.

C. Prepare and prime paint other steel surfaces as follows:
   1. Surface preparation: SSPC SP3 "Power Tool Cleaning".
   2. Primer: Standard Shop Primer, at 2.5 mils dry film thickness. Where steel is scheduled to be finish painted, verify that primer is compatible with finish painting systems.

2.6 SOURCE QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section, "Quality Requirements".

B. Testing Laboratory will:
   1. Collect mill test reports and certificates, verifying compliance with specified requirements.
   2. Review welding procedure specifications. Verify that machine settings and travel speed correspond to electrode manufacturer's recommendations.
   3. Collect and review qualifications of welders.
   4. Review material identification and control procedures.
   5. Inspect shop and field welding in accordance with requirements of CBC Section 1704, "Special Inspections".
   6. Ultrasonic test 100 percent of complete joint penetration welds in materials 5/16-inch or greater.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 ERECTION

A. Erect structural steel in accordance with AISC 303 and ANSI/AISC 360.

B. Where erection requires performing work of fabrication on site, conform to applicable requirements of "Fabrication".

C. Field corrections will not be permitted without the prior approval of the Owner's Representative.

D. Field Touch-Up Painting:
   1. Where steel is scheduled to be finish painted, touch-up paint field welded connections and abrasions using same paint used for shop priming.
   2. Prior to painting welds, thoroughly chip and wire brush. Wash with dilute solution of phosphoric acid (approximately 5%) and rinse with water. Allow surface to dry prior to painting.
   3. Touch up galvanized surfaces in accordance with ASTM A780.

3.3 CLEANING

A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of fire-retardant coating, paint or concrete.

3.4 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section, "Quality Requirements".

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Safety gate system.

B. Related Requirements:

   1. 09 97 00 “High-Performance Coating System for Exterior Stainless Steel.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to other work. Furnish setting drawings, templates, and directions for installing anchorages, anchor bolts

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Safety gate system
   2. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.

1.4 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

B. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Minimum 5 years documented experience in work of this Section.

B. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE AND HANDLING

A. Store steel above ground on platforms, skids, or other supports; separate with wooden separators.

B. Protect steel from corrosion.

C. Prevent damage to [prime coat] [and] [galvanized coatings]

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

E. Cold-Rolled Furring Channels:

1. Framing Members: AISI S240 for conditions indicated.
2. Grade: ST33H.
3. Coating: G90 (Z275 or equivalent.
4. Steel: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

    a. Grade: 33.

5. 0.053-inch hot-dipped galvanized uncoated-steel thickness, with minimum 1/2-inch wide flanges.
6. Depth: As indicated on Drawings.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening stainless steel.

B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

C. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 SELF-LATCHING GATE

A. Manufacturer's standard system, including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to floor structure and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

B. Height: 42 inches above floor finish.
   1. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
   2. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
   3. Self-Latching Gate: Provide manufacturer's standard hinges and self-latching mechanism.
   4. Fasteners: Manufacturer's standard, finished to match railing system.
   5. Finish: Manufacturer's standard.
      a. Provide standard samples for architect’s selection.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel sheet, shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous stainless steel panels with primer specified in Section 099600 "High-Performance Coatings" where indicated.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 099600 "High-Performance Coatings" are indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
1. Softwood structural framing.
2. Plywood wall.
3. Wood furring, blocking, backing, corners, and nailers as required for finishes and for support of accessories and finish hardware.
4. Connectors and fastenings for wood framing.

1.2 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section.

C. American Forest and Paper Association (AFPA)
1. NDS – National Design Specification for Wood Construction, 2019

D. American Institute of Timber Construction (AITC)
1. ANSI/AITC A190.1 - Structural Glued Laminated Timber, 2007.

E. American Wood Protection Association (AWPA)
1. AWPA U1 - Use Category System: User Specification for Treated Wood, 2019

F. CBC - 2022 California Building Code.

G. ICC-ES Evaluation Report: Where designated in this Section, products shall have an active ICC Evaluation Service, Inc. Evaluation Report evidencing compliance with provisions of the 2015 International Building Code.

H. U.S. Department of Commerce (DOC)
1. PS1 – Product Standard for Structural Plywood, 2009.
2. PS20 – American Softwood Lumber Standard, 2015.

I. West Coast Lumber Inspection Bureau's
1. WCLIB - Standard Grading Rules No. 17.

1.3 ACTION SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittals".

B. Product Data: For manufactured products, including framing connectors.

1.4 QUALITY ASSURANCE

A. Lumber and plywood shall bear grade-trademarks of appropriate grading agency.
   1. Pressure preservative treated lumber and plywood shall bear an AWPA tag.
   2. Fire-retardant-treated lumber shall bear the stamp of the inspection agency in accordance with ICC-ES AC66, "Acceptance Criteria for Fire-Treated Wood".

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces. Keep lumber and plywood dry. Stack off ground and fully protected from weather.

PART 2 - PRODUCTS

2.1 LUMBER

A. Sizes and Surfacing: Provide dressed lumber, S4S. Where nominal sizes are designated, provide actual sizes required by DOC PS 20.

B. Moisture Content: For nominal 4-inch and narrower lumber, maximum moisture shall be 19 percent at time of delivery to jobsite.

C. Species and Grades: Provide Douglas Fir structural lumber of the grades listed below for the various purposes, except as otherwise designated on Drawings:
   1. Typical, unless noted otherwise: WCLIB No. 1.
   2. Studs, blocking and backing (6-inch maximum dimension): WCLIB No. 2.
   3. Joists, solid blocking, and built-up headers (2 inches and thicker, 6 inches and wider): WCLIB No. 1, S-dry.
   4. Headers, framing beams, ledgers and blocking above deck (nominal 4 inches and thicker, 6 inches and wider): ANSI/AITC A190.1 glue-laminated lumber, stress class SC 24F - 1.8 E, framing appearance grade.
   5. Posts (6 inches thick, 6 inches and wider): WCLIB No. 1, 25 percent maximum moisture content shall be acceptable.
   6. Decking (exposed to view): Solid sawn, tongue and groove roof decking, NLGA Selected Decking Grade, MC15 to KD15 moisture content.
   7. Preservative treated lumber: WCLIB No. 1, pressure preservative treated as specified herein.

2.2 SHEATHING

A. General: Sheathing panels shall be structural plywood conforming to DOC PS-1, except as otherwise designated.
   1. Conform to requirements specified herein for various purposes, except as otherwise designated on Drawings.

B. Wall Sheathing: APA STRUCTURAL I Rated Sheathing 32/16, Exposure 1, 5-ply minimum.

2.3 TREATED WOOD MATERIALS

A. Preservative Treated Lumber: and Plywood: Pressure treatment of wood products shall conform to the requirements for the specified Use Category in accordance with AWPA U1. The following items shall be preservative treated:
   1. Wood sills in contact with concrete foundations or floor slabs on ground: Use Category UC2.

2. Wood framing and plywood wall sheathing at the first-floor level of structures having crawl spaces when the bottoms of such items are 24 inches or less from the earth underneath. Use Category UC2.
3. Wood sills or ledgers in contact with concrete or masonry that is exposed to weather: Use Category UC2.
4. Nailers, edge strips, crickets, curbs, and cants for roof decks: Use Category UC2.

B. Fire-retardant Treated Lumber and Plywood: Conform to requirements of Use Category UCFA in accordance with AWPA U1.

C. Kiln dry treated lumber to 19% and plywood to 15% moisture content after treatment.

2.4 FASTENERS AND CONNECTORS

A. General: Provide fasteners and connectors of size and type indicated that comply with this Article for material and manufacture. Where proprietary fasteners are substituted for commodity fasteners, submit product data and obtain approval of Owner's Representative prior to use.

B. Steel fasteners and connectors exposed to weather or in contact with preservative or fire-retardant treated lumber shall be protected as specified below, or with specialty coating recommended by manufacturer and approved by Owner's Representative.
1. Exterior exposure: Hot-dip galvanized in accordance with ASTM A153
2. Contact with treated wood: CBC Section 2304.10.5.

C. Nails and Staples: ASTM F1667 and CBC Section 2302.6; or proprietary nails.
1. Nail sizes indicated on Drawings are common nails, unless otherwise indicated.
2. Provide ring shank nails for fastening of floor sheathing.

D. Framing Connectors: Designations shown on Drawings refer to products of Simpson Strong-Tie Company. Products of other manufacturers that have current ICC Evaluation Service approved load values similar to designated products shall be acceptable. Acceptable manufacturers are Simpson Strong-Tie Co., K.C. Metal, United Steel products, or equal.

E. Bolts and Anchor Bolts: ASTM A307, Grade A, hex head bolts with matching nuts. Furnish with ASTM F844 flat washers where head or nut bears against wood.

F. Lag Bolts: ANSI/ASME B18.2.1. Furnish with ASTM F844 flat washers where head bears against wood.

G. Wood Screws: ANSI/ASME B18.6.1.

H. Threaded Rod: ASTM A36 or SAE 1018, continuously threaded mild steel rod.
1. Couplers: ICC Evaluation Service accepted and load rated to develop strength of rod. Acceptable products are: CNW series coupler nuts by Simpson Strong-Tie Co., or equal.

I. Plate Washers: Mild steel, size and thickness to match BP-series bearing plates by Simpson Strong-Tie Co,

PART 3 - EXECUTION

3.1 FRAMING

A. Construct light framing according to CBC Section 2308, "Conventional Light Frame Construction", where not otherwise shown or specified.

B. Make proper provisions for work of other trades. Lay out framing to accommodate plumbing, electrical, HVAC and other trades.

C. Fasten as indicated. Locate fasteners to avoid knots, splits and areas of non-uniform grain. Select and/ or trim members to be free of defects at major connections.

D. Perform cutting, boring and notching of wood members to avoid weakening of members. Obtain approval of Owner's Representative to exceed typical limitations shown on Drawings. Use proper tools to make cut neat holes of appropriate size. Repair damaged members with metal plates or replace, as directed by Owner's Representative.

E. Joist Framing:
1. Set joists with the crown edge up with full bearing on supports.
2. Provide doubled floor joists under partitions running parallel with the joists. Where necessary for passage of pipes or ducts, space doubled joists as required for pipe or duct clearance and install solid blocking between joists at 4 feet on center and nail securely.
3. Where openings occur, headers and supporting joists shall be doubled and headers and tail joists shall be hung on metal hangers.
4. Provide metal hangers for joists framing to sides of headers, beams and ledgers.

3.2 WALL SHEATHING

A. General
1. Place panels with end joints staggered and bearing firmly on supports.
2. Back square edges with minimum 2 x 4 flat blocking, except provide minimum 3x4 blocking where panel edge nailing is 3 inches or less.
3. Provide 1/8-inch space at panel edge and end joints.
4. Place nails not less than 3/8 inches from panel edges and drive solidly into support. Drive head flush with surface of sheathing panel; do not overdrive.
5. Hold ends and edges back 1/2 inch from concrete or masonry surfaces. Where sheathing is applied over concrete or masonry, provide 1/2 inch minimum air space behind panel.

3.3 CONNECTORS AND FASTENERS

A. General: Install in accordance with provisions of the CBC, applicable ICC Evaluation Service Reports, and industry practice.

B. Nailing: Where nailing is not indicated, conform to CBC Table 2304.9.1 and CBC Section 2308 requirements for Conventional Light-Frame Construction. When wood tends to split with size of nail used, predrill holes.

C. Bolting: Holes size in wood shall be bolt diameter plus 1/16 inch.

D. Metal Framing Connectors: Install connectors in accordance with manufacturer's ICC Evaluation Service Report, except as otherwise designated. Use nails specially manufactured for use with connection hardware being employed.

3.4 FURRING, NAILERS AND BACKING

A. Wood grounds, nailers, blocking and sleepers:
1. Provide wherever indicated and where required for attachment of other work. Form to shapes as indicated and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

2. Attach to substrates as required to support applied loading. Install fasteners flush with surfaces, unless otherwise indicated.

B. Wood furring: Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work. Firestop furred spaces with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

C. Backing: Anchor to studs with nails or screws as required to support and back up finish carpentry, casework, flashing, fittings, fixtures, specialty items, accessories, mechanical and electrical work and items of similar nature.

3.5 PROTECTION

A. Protect framing that will remain exposed-to-view in completed construction from exposure to rain following installation.

3.6 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section "Quality".

B. Testing Laboratory will:
1. Special Inspect Seismic Lateral Force Resisting System in accordance with CBC Section 1707.3.

END OF SECTION

SECTION 071416

COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Urethane waterproofing.
   2. Accessory waterproofing system materials.
   3. Sheet metal flashing.

1.2 DEFINITIONS

A. Compatible: Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.

B. Chemical Compatibility: Material that will not break down, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.

C. Adhesive Compatibility: Material that will develop bond strength or provide a suitable surface for another material to develop bond strength complying with requirements when in contact with another material.

1.3 COORDINATION

A. Coordinate Work under this Section with adjacent work.

B. Coordinate requirements to provide suitable substrate for waterproofing and to minimize penetrations in waterproofing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review waterproofing requirements, including, but not limited to, the following:

      a. Surface preparation specified in other Sections.
      b. Minimum concrete curing period.
      c. Forecasted weather conditions.
      d. Special details and sheet flashings.
      e. Repairs.
      f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings:

1. Indicate locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, expansion-joint conditions, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For the following materials:

1. Cured sample of waterproofing membrane on suitable rigid substrate, 8 by 8 inches .
2. Fabric backed tape, 12 inches long..

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Field quality-control reports.

C. Sample warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Entity that employs installers and supervisors who are trained and certified by waterproofing manufacturer.

1.8 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build mockup for each typical waterproofing installation, including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.

   a. Size: 100 sq. ft..
   b. Description: Each type of plaza deck installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer. Protect stored materials in accordance with manufacturer's written instructions.

B. Remove and replace materials that cannot be applied within their stated shelf life.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.

1. Do not apply waterproofing to frozen, damp, or wet substrates, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
2. Do not apply waterproofing when snow, rain, fog, or mist are present, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.11 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or remove and replace waterproofing that fails to remain watertight within specified warranty period.

1. Warranty includes leak remediation.
2. Warranty Period: **10** years from date of Substantial Completion.

B. Installer's Special Warranty: Submit warranty signed by Installer, covering the Work of this Section, for warranty period of **two** years from date of Substantial Completion.

1. Warranty includes leak remediation, including repair, removal, and replacement of overlying construction.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Waterproofing System: Obtain waterproofing materials from same manufacturer as waterproofing membrane.

2.2 POLYURETHANE WATERPROOFING

A. Liquid-applied, Polyurethane Waterproofing: ASTM C836.

1. Basis-of-Design Manufacturer: C.I.M. Industries CIM 1000.

2.3 ACCESSORY WATERPROOFING SYSTEM MATERIALS

A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.

B. Primer: Liquid primer as recommended in writing for substrate by waterproofing manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner as recommended in writing for substrate by waterproofing manufacturer.

D. Sheet Flashing: Manufacturer's standard flashing sheet.

1. Adhesive: Manufacturer's standard contact adhesive.

E. Reinforcing Fabric: Manufacturer's standard fiberglass mesh or spun-bonded polyester fabric.

F. Detailing Seam Tape: Manufacturer's standard detailing tape.

G. Joint Sealant: Polyurethane sealant, compatible with waterproofing; and as recommended in writing by waterproofing manufacturer for substrate and joint conditions.

H. Backer Rod: Closed-cell polyethylene foam.

I. Sheet Metal Materials:

1. Stainless Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed.

a. Nominal Thickness: 0.050 inch.

2. Surface: Smooth flat.
3. Exterior Finish: ASTM A480/A480M No. 4.

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1) Run grain of directional finishes with long dimension of each piece.

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

2.4 PROTECTION COURSE

A. Protection Course: High-strength drainage composite made up of a heavy-weight nonw0ven filter fabric bonded to individual dimples of a molded polystyrene core:

1. Basis-of-Design Product: Carlisle MiraDrain 9800.
2. Thickness: Nominal 0.40 inch (3/8 inch) for horizontal applications.

2.5 SHEET METAL FABRICATION

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Deck Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12 ft. long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches wide.
2. Fabricate from the following materials:

    a. Stainless Steel: 0.0188 inch thick.

B. Expansion Joint Cover: Fabricate deck edge flashings from the following material:

1. Stainless Steel: 0.0250 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that concrete has cured and aged for minimum time period as recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits as recommended in writing by waterproofing manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates in accordance with waterproofing manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate in accordance with ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces in accordance with ASTM D4258.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

F. Coordinate with Owner for impact to air-intake equipment in the vicinity of the Work. Cover or filter air-intake louvers before proceeding with work that could affect indoor air quality or that could activate smoke detectors in the ductwork.

G. Perform adhesion tests to conform adequacy of surface preparation in accordance with manufacturers printed instructions.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions.

3.4 TREATMENT OF JOINTS AND CRACKS

A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898 and ASTM C1471. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.

1. Comply with ASTM C1193 for joint-sealant installation.
2. Apply bond breaker on sealant surface, beneath preparation strip.
3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches wide along each side of joint. Apply waterproofing in two separate applications and embed a joint-reinforcing strip in first preparation coat.

3.5 INSTALLATION OF DECK EDGE FLASHINGS

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings

1. Extend sheet flashings for 4 inches onto perpendicular surfaces.

B. Install deck edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

C. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

3.6 INSTALLATION OF WATERPROOFING

A. General: Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C898 and ASTM C1471.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. Apply primer over prepared substrate at manufacturer's recommended rate and allow it to dry.

D. Unreinforced Waterproofing Membrane Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.

1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a minimum dry film thickness of 120 mils.
2. Apply waterproofing to prepared wall terminations and vertical surfaces.
3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft..

E. Cure waterproofing, taking care to prevent contamination and damage to membrane.

3.7 PROTECTION COURSE

A. Plaza Decks:
1. Place fabric side up in accordance with manufacturer’s instructions.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections:

1. Testing agency to verify thickness of waterproofing during application for each 600 sq. ft. of installed waterproofing or part thereof.

B. Perform the following tests before overlying construction is placed:

1. Flood Testing: Flood test each completed horizontal waterproofed area for leaks, in accordance with recommendations in ASTM D5957. Install temporary containment assemblies, plug, or dam drains, and flood with potable water.

a. Flood to an average depth of 2-1/2 inches with a minimum depth of and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
b. Flood each area for **72** hours.
c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installations are watertight.

1) Cost of retesting is the responsibility of Contractor.

d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.

C. Manufacturer's Field Service: Engage a full-time site representative qualified by waterproofing system manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.

1. Final Inspection: Arrange for waterproofing system manufacturer's technical personnel to inspect system installation on completion, in presence of Architect, and to prepare inspection report.
2. Notify Architect and Owner 48 hours in advance of date and time of inspection.
3. Repair or remove and replace components of waterproofing system where inspections indicate that they do not comply with specified requirements.

D. Additional Tests and Inspections:

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
2. Waterproofing system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 PROTECTION AND CLEANING

A. Protect waterproofing system from damage and wear during remainder of construction period.

B. Protect installed from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where material is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing system that does not comply with requirements, repair substrates, and repair or reinstall waterproofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

SECTION 072401

SANTA BARBARA MISSION FINISH (SBMF)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Santa Barbara Mission Finish (SBMF) applied exterior finish over existing portland cement plaster substrate.

1.2 ACTION SUBMITTALS

A. Product Data: Submit complete product data. Include installation instructions.

B. Shop Drawings: Indicate joint details and locations.

C. Samples: Submit one 2x4 foot finish sample for each color and finish texture combination proposed for the work. Submit additional samples until a sample for each combination is approved by the Architect.

D. Quality Control Submittals:

1. Certifications: Submit certifications that the installer meets the qualification requirements specified.

E. Closeout Submittal:

1. Manufacturer's recommended procedures for maintenance, including requirements for periodic inspection, sealant maintenance, and cleaning.

1.3 QUALITY ASSURANCE

A. The SBMF manufacturer shall be a member of the Exterior Insulation Manufacturer's Association (EIMA).

B. Applicator Qualifications:

1. Minimum of 5 years' experience in the application of SBMF of similar scope to the work indicated.
2. Installer shall have been trained by the product manufacturer prior to bidding, and shall be currently approved by the manufacturer to install warrantable SBMF system as specified.

C. Regulatory Requirements:

1. The SBMF shall be accepted by ICC Evaluation Report as conforming to the currently enforced edition of the IBC, including as a noncombustible assembly suitable for use in non-combustible construction.
2. The SBMF shall be approved by the jurisdictional code authorities.

D. Mock-up:

1. Provide an approximate 100 square foot mock-up of the in-place work in a location as directed by the Architect. Extend mock-up to the nearest corner or break lines.
2. Accepted mock-ups may be incorporated into the work.

E. Pre-Installation Conference:

1. Schedule and administer a meeting to review and discuss the installation a minimum of one week (7 work days) prior to commencement of work of this Section.
2. Attendance: Contractor, SBMF installer, sealant installer, and other parties affected by work of this Section.
3. Agenda: Include acceptance of substrate, installation scheduling and procedures, masking and protection of adjacent work, mock-up review, coordination, protection of work during installation, overage, control and expansion joints, sealant joint details and locations, criteria for acceptance of work, field quality control, and cleaning procedures.

1.4 FIELD CONDITIONS

A. Environmental Requirements:

1. Temperature: Apply system only on unfrozen surfaces and at ambient temperatures above 40 degrees F. Maintain ambient temperature above 40 degrees F. for minimum of 24 hours after installation. Provide supplementary heat if required.
2. Moisture: Apply system to dry surfaces only.
3. Ambient and surface temperature must be over 40-degrees F or higher during application.
4. Ambient and surface temperatures must not exceed 120 degrees F during and after application.
5. Do not apply in direct sunlight conditions in hot weather.
6. Protect from freezing for a period of not less than 48 hours after set has cured.
7. Provide supplemental head and protection from precipitation as needed.

B. Protection: Protect adjacent materials and this system from weather and other damage during installation, while curing or when unattended.

1.5 STORAGE AND HANDLING

A. Store materials off ground and protect from rain and moisture.

1.6 WARRANTY

A. Provide manufacturer's 3 year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. LaHabra by Parex USA, inc.

2.2 COMPOSTION

A. Binder: Portland cement and hydrated lime.

B. Aggregates.

C. Proprietary additives.

2.3 MATERIALS

A. Provide manufacturer's standard materials as recommended for the installation.

1. Hydrated Lime: ASTM C206, Type S.
2. White Portland Cement: ASTM C150, Type 1.

B. Finish Coat: ASTM C926; LaHabra Santa Barbra Mission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify flashing and similar elements to be built-in to the EIFS are properly installed.

3.2 PREPARATION

A. Protect adjacent surfaces from contact with overspray and spatter of primers, adhesives, and finish coats.

3.3 FINISH COAT ONLY APPLICATION

A. Dampen the existing portland cement plaster with clean water prior to the application of SBMF stucco finish.

B. Allow surface moisture to dissipate prior to the application of the SBMF finish.

C. Where indicated provide finish coat only over cement plaster surfaces as indicated on Drawings.

D. Apply SBMF finish coating as recommended by the SBMF finish system manufacturer.

E. Trowel or float apply an even coat completely covering the existing substrate and allow it to set although prior to drying out, trowel apply a second tight coat of the same material over the first to the desired finish level.

3.4 CLEAN UP

A. Remove dirt and stains from SBMF surfaces and adjacent surfaces without damaging finishes.

END OF SECTION

SECTION 08 41 13

GLAZED ALUMINUM ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Glazed aluminum entrance doors for installation in glazed aluminum storefronts.

B. Related Sections include:

1. Section 08 71 00 "Door Hardware" for hardware installed on aluminum entrance doors in glazed aluminum storefront systems.
2. Section 08 81 00 "Glass Glazing" for glass installed in aluminum entrance.

1.3 REFERENCES

A. Aluminum Association (AA).

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 501.2: Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.
2. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 2605: Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels.

C. ASTM International:

1. ASTM A36: Standard Specification for Carbon Structural Steel.
2. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A1008: 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.
5. ASTM A1011: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
6. ASTM B209: Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

7. ASTM B221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
8. ASTM B308: Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
9. ASTM B429: Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
10. ASTM C509: Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
11. ASTM C864: Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
12. ASTM C920: Standard Specification for Elastomeric Joint Sealants.
13. ASTM C1184: Standard Specification for Structural Silicone Sealants.
14. ASTM C1401: Standard Guide for Structural Sealant Glazing.
15. ASTM D256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
16. ASTM D1187: Standard Specification for Asphatl-Base Emulsions for Use as Protective Coatings for Metal.
17. ASTM D2244: Standard Practice for Calculation of Color Tolerances and Color Differences From Instrumentally Measured Color Coordinates.
18. ASTM D2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor.
19. ASTM D4214: Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
20. ASTM E283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
21. ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
22. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
23. ASTM E699: Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

D. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.

E. Division of the State Architect (DSA):
1. Interpretation of Regulations IR 24-2, "Window Wall Systems" (Last Revision: 9/22/17).

F. National Association of Architectural Metal Manufacturers (NAAMM):
1. Metal Finishes Manual for Architectural and Metal Products.

G. National Fenestration Rating Council (NFRC):
1. NFRC 100: Procedure for Determining Fenestration Product U-Factors.
2. NFRC 200: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

H. Society for Protective Coatings (SSPC):
   1. SSPC-PS Guide No. 12.00: Guide to Zinc-Rich Coating Systems.
   2. SSPC-SPCOM: Surface Preparation Commentary for Steel and Concrete Substrate.

I. United States Department of Justice:
   1. 2010 ADA Standards for Accessible Design.

1.4 COORDINATION

A. Coordinate design and fabrication of aluminum entrance doors with scheduled finish hardware specified in Section 08 71 00 "Door Hardware."

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Confererence: Conduct conference at Project site to review pertinent issues related to glazed aluminum entrances and storefronts.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum entrance and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Shop Drawings shall be signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Include structural analysis data indicating compliance of installed system with specified performance requirements and design criteria, signed and sealed by the qualified professional engineer responsible for their preparation.
      a. Anchorage of aluminum storefront systems to adjacent construction as may be indicated on Drawings is only for purposes of obtaining preliminary approval of Drawings from the AHJ, and is not intended as the final design. Actual anchorages are to be fully engineered (with supporting calculations) to specified performance requirements, and indicated on Shop Drawings.
      b. Indicate structural loadings and reactions to be transmitted to building structure.
   3. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.

4. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
5. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
6. Shop Drawings and structural analysis as specified above require review and approval by Division of the State Architect (DSA) under Deferred Approval process. Review and return of Shop Drawing submittal is contingent on review and approval by DSA.

C. Samples for Initial Selection: For units with factory-applied color finishes, submit manufacturer's full range of colors for selection by Architect.
   1. Minimum Number of Colors for Selection: 15.

D. Samples for Verification: For each type and color of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
   1. Refer to Section 08 71 00 "Door Hardware" for hardware installed on aluminum entrance systems, but not specified in this Section.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Installer.
   2. For professional engineer's experience with providing delegated-design engineering services for the kind indicated, including documentation that the engineer is licensed in the state in which Project is located.

B. Energy Performance Certificates: For glazed aluminum entrances and storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum entrance and storefront.

C. Product Test Reports: For glazed aluminum entrances and storefronts, for tests performed by a qualified testing agency.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.

E. Compatibility and Adhesion Test Reports: For structural-sealant-glazing, test reports from sealant manufacturer indicating that joint sealants have been tested for each material that will come in contact with sealants.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum entrance and storefront systems that meet or exceed performance requirements indicated and of documenting this performance by test reports, and structural calculations.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated, and acceptable to Owner and Architect.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems and components that include structural glazing.

F. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's written approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

G. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical storefront area as directed by Architect.
2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.10 FIELD CONDITIONS

A. Field Measurements: Where glazed aluminum storefront system is indicated to fit other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.11 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components to function properly.
2. Warranty Period: 2 years from date of Substantial Completion.

B. Special Finish Warranty – Fluoropolymer Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied fluoropolymer finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 20 years from date of Substantial Completion.

C. Special Finish Warranty – Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Aluminum Entrance and Storefront Systems: Obtain all components of aluminum storefront and entrance system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Comply with performance requirements specified, as determined by testing of aluminum entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Delegated Design: Engage a qualified professional engineer to design aluminum storefront system, including anchorage to building construction, using comprehensive engineering analysis to address specified structural loads and design criteria.
2. Comply with requirements of California Division of the State Architect Interpretation of Regulations IR 24-2, "Window Wall Systems" (Last Revision: 9/22/17).
3. Aluminum entrances and storefronts shall withstand movement of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
4. Allow for dimensional tolerances of building frame and other adjacent construction.
5. Failure also includes the following:
    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    d. Glass breakage caused by transferring of stresses caused by thermal or structural movements.
    e. Noise or vibration created by wind and thermal and structural movements.
    f. Loosening or weakening of fasteners, attachments, and other components.
    g. Sealant failure.
    h. Failure of operating units to function properly.

B. Structural Requirements:

1. Glazed aluminum storefront system shall be capable of withstanding the effects of the following:

a. Wind loads and stresses calculated based on requirements of the California Building Code, using factors defined therein and applicable to local site conditions and specific project parameters.

i) Wind Speed: As per California Building Code, as determined by project location and Risk Category of building.

a) Risk Category: III

b. Seismic Loads: Earthquake motions determined according to requirements of the California Building Code and Seismic Design Category specific to project.

2. Deflection of Framing Members: At design wind pressure, as follows:

a. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches, and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches, or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

b. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch and clearance between members and operable units directly below them to less than 1/16 inch.

c. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection perpendicular to plane of wall to no greater than 1/240 of clear span plus ¼ inch for spans greater than 11 feet 8-1/4 inches or 1/175 of clear span for spans less than 11 feet 8-1/4 inches.

3. Anchorage of Aluminum Storefront Systems to Adjacent Construction: Capable of resisting specified structural loads.

C. Interstory Drift: Accommodate design displacement of adjacent stories, as calculated in accordance with the California Building Code.

D. Testing:

1. Structural: Test exterior storefront systems according to ASTM E330 as follows:

a. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

b. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.

c. Test Durations: As required by design wind velocity but not less than 10 seconds.

2. Air Infiltration: Test exterior storefront systems according to ASTM E283 as follows:

a. Fixed Framing and Glass Area: Maximum air leakage of 0.06 cfm per square foot at a static-air-pressure differential of 6.24 lbf per square foot.

b. Entrance Doors:

i) Double Doors: Maximum air leakage of 1.0 cfm per square foot at a static-air-pressure differential of 1.57 lbf per square foot.

3. Water Penetration Under Static Pressure: Test exterior storefront systems according to ASTM E331 as follows:
   a. Fixed Framing and Glass Area: No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 8 lbf per square foot.

E. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
   1. Thermal Transmittance (U-Factor) at Fixed Glazing: Not more than 0.41 Btu/sq ft x h x deg F as determined according to NFRC 100.
      a. Thermal Transmittance (U-Factor) at Glazed Doors: Not more than 0.57 Btu/sq ft x h x deg F as determined according to NFRC 100
   2. Solar Heat Gain Coefficient at Fixed Glazing: No greater than 0.26 as determined according to NFRC 200.
      a. Solar Heat Gain Coefficient at Glazed Doors: No greater than 0.23 as determined according to NFRC 200.

F. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

G. Structural-Sealant Joints:
   1. Designed to carry gravity loads of glazing.
   2. Designed to produce tensile or shear stress of less than 20 psi with minimum factor of safety of 5.

H. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
   1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
   2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

I. Entrances: Comply with applicable provisions of the following for accessible entrances:
   1. California Building Code (Title 24, Part 2), Chapters 11A and 11B.
   2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.3 ALUMINUM ENTRANCES AND STOREFRONTS, GENERAL

A. Aluminum Storefront System: Manufacturer's aluminum storefront system meeting specified performance requirements, fabricated from extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads. Spacing and layout of framing members is indicated on Drawings.

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
2. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOORS

A. Thermal Entrance Doors: Manufacturer's thermally-broken glazed entrance doors for manual-swing operation.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Efco Corporation; Series D502 Thermastile.
   b. Kawneer North America, an Arconic Company; 500T Wide Stile Insulpour Thermal Entrance.
   c. Oldcastle BuildingEnvelope; WS-500TC Thermal Composite Door.
   d. Equal product in accordance with Division 1 requirements for product substitutions.
2. Door Construction: 2 to 2-1/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
3. Door Design: Stile and rail, as follows:
   a. Stiles: 5 inches wide.
   b. Top Rail: 5 inches wide.
   c. Bottom Rail: 10 inches high, except where noted otherwise on Drawings.
4. Glazing Stops and Gaskets: Square snap-on, extruded-aluminum stops and preformed gaskets.
5. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
6. Finish: Match finish of storefront system in which glazed doors are being installed.

2.5 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
   3. Extruded Structural Pipe and Tubes: ASTM B429.
   4. Structural Profiles: ASTM B308.

B. Steel Reinforcement:
   1. Structural Shapes, Plates, and Bars: ASTM A36.
   2. Cold-Rolled Sheet and Strip: ASTM A1008.
   3. Hot-Rolled Sheet and Strip: ASTM A1011.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.6 ACCESSORIES

A. Brake Shape Closures: Minimum 0.090-inch thick aluminum sheet matching finish of aluminum framing members.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Where exposed, use fasteners with countersunk Phillips screw heads, finished, to match framing system.
   4. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

D. Flashing:
   1. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding flashing compatible with adjacent materials.
   2. Exposed Flashing: From sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection or deformation.

E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with ASTM D1187 requirements, and containing no asbestos, formulated for 30-mil thickness per coat.

2.7 GLAZING

A. Glazing: Comply with Section 08 81 00 ”Glass Glazing.”

B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Spacers and Setting Blocks: As specified in Section 08 81 00 “Glass Glazing.”

D. Glazing Sealants: As recommended by manufacturer.

E. Structural Glazing Sealants:

1. Structural Glazing Sealants: ASTM C1184, neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in skylight system indicated.
   a. Color: Black.
2. Weatherseal Sealants: ASTM C920 for Type S; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended in writing by structural-sealant, weatherseal sealant, and structural-sealant-glazed skylight manufacturers for this use.
   a. Color: Match structural sealant.
3. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

7. At angled or curved layouts in plan, components curved or angled to indicated layout.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Entrance Door Frames: Reinforce as required to support loads and impacts imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weatherstripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide weatherstripping at meeting stiles, as specified in Section 08 71 00 "Door Hardware."
2. At exterior doors, provide weather sweeps applied to door bottoms, as specified in Section 08 71 00 "Door Hardware."

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As selected by Architect from manufacturer's full range.

2.10 SOURCE QUALITY CONTROL

A. Structural-Sealant Glazing: Perform quality-control procedures complying with ASTM C1401 recommendations including, but not limited to, material qualification procedures, sealant testing, and fabrication reviews and checks.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.
   1. Do not install damaged components.
   2. Fit joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure nonmovement joints.
   4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration, and to prevent impeding movement of moving joints.
   5. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   6. Seal perimeter and other joints watertight, unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose, or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

E. If required by manufacturer to achieve a weathertight installation, set continuous sill members and flashing in sealant as specified in manufacturer's instructions.

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weatherstripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturer's written instructions using concealed fasteners to greatest extent possible.

3.4 GLAZING

A. Glazing: Install glazing as specified in Section 08 81 00 "Glass Glazing."

B. Structural-Sealant Glazing:
   1. Prepare surfaces that will contact structural sealant according to structural-sealant manufacturer's written instructions to ensure compatibility and

adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

2. Set glazing into framing according to sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
3. Set glazing with proper orientation so that coatings face exterior or interior as specified.
4. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
5. Apply structural sealant to completely fill cavity, according to sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
    a. Apply structural sealant at temperatures indicated by sealant Allow structural sealant to cure according to manufacturer's written instructions manufacturer for type of sealant.
6. Allow structural sealant to cure according to manufacturer's written instructions.
7. Installation of Weatherseal-Sealant:
    a. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
    b. Install weatherseal-sealant according to weatherseal-sealant manufacturer's written instructions to produce weatherproof joints.

C. Clean and protect glass in indicated in Section 08 81 00 "Glass Glazing."

3.5 ERECTION TOLERANCES

A. Install glazed aluminum entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on both mockups, and representative areas of installed glazed aluminum entrance and storefronts:

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect or Project Inspector shall be tested according to AAMA 501.2 and shall not evidence water penetration.
    a. Perform a minimum of one test for each type of storefront system in areas directed by Architect or Project Inspector.

C. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
    1. Perform one test for every 100 feet of joint length, but not less than one test for each building elevation.
    2. Repair installation areas caused by testing.

D. Glazed aluminum storefronts will be considered defective if they do not pass tests and inspections

E. Repair or remove work where test results and inspections indicate compliance with specified requirements has not been achieved.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.7 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturer's written instructions.
    1. For doors accessible to persons with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

B. Adjust hardware, and accessories for a tight fit at contact points and weatherstripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

END OF SECTION 08 41 13

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
   2. Electrified door hardware.

B. Related Sections include:
   1. Section 06 10 00 "Rough Carpentry" for concealed blocking and framing for support of doorstops and other wall-mounted hardware items.
   2. Section 08 11 13 "Hollow-Metal Doors and Frames" for hollow-metal steel doors and frames to receive door hardware provided.
   3. Section 08 41 13 "Glazed Aluminum Storefront, Curtainwall, and Entrance Systems" for aluminum-framed entry systems to receive door hardware specified in this Section.

1.2 REFERENCES

A. ASTM International (American Society for Testing and Materials):
   1. ASTM E 283: Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Wall, and Doors Under Specified Pressure Differences Across the Specimen.

B. Builders Hardware Manufacturers Association (BHMA):
   1. BHMA A156.1: Butts and Hinges.
   2. BHMA A156.2: Bored and Preassembled Locks & Latches.
   3. BHMA A156.3: Exit Devices.
   4. BHMA A156.4: Door Controls – Closers.
   5. BHMA A156.5: Auxiliary Locks and Associated Products.
   6. BHMA A156.6: Architectural Door Trim.
   7. BHMA A156.8: Door Controls – Overhead Stops and Holders.
   8. BHMA A156.13: Mortise Locks & Latches Series.
   9. BHMA A156.14: Sliding & Folding Door Hardware.
   10. BHMA A156.15: Release Devices – Closer Holder, Electromagnetic and Electromechanical.
   11. BHMA A156.16: Auxiliary Hardware.
   12. BHMA A156.17: Self-Closing Hinges & Pivots.
   13. BHMA A156.18: Materials and Finishes.

14. BHMA A156.21: Thresholds.
15. BHMA A156.22: Door Gasketing and Edge Seal Systems.
16. BHMA A156.25: Electrified Locking Devices.
17. BHMA A156.26: Continuous Hinges.
18. BHMA A156.28: Recommended Practices for Keying Systems.
19. BHMA A156.31: Electric Strikes and Frame-Mounted Actuators.

C. Door and Hardware Institute (DHI):
1. DHI Handbook: Sequence and Format for the Hardware Schedule.
2. DHI Handbook: Recommended Locations for Architectural Hardware for Flush Wood Doors.

D. Hollow Metal Manufacturers Association (HMMA):
1. HMMA 831: Recommended Hardware Locations for Custom Hollow Metal Doors and Frames.

E. National Fire Protection Association (NFPA):
1. NFPA 70: National Electrical Code.
2. NFPA 80: Fire Doors and Fire Windows.
3. NFPA 101: Life Safety Code.
4. NFPA 105: Standard Practice for the Installation of Smoke Door Assemblies and Other Opening Protectives.
5. NFPA 252: Methods of Fire Tests of Door Assemblies.

F. Steel Door Institute (SDI):
1. ANSI/SDI A250.6: Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
2. ANSI/SDI A250.8 (Formerly SDI-100): Recommended Specifications for Standard Steel Doors and Frames.

G. Underwriters Laboratory (UL):
1. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
2. UL 305: Panic Hardware.
3. UL 1784: Air Leakage Tests for Door Assemblies.

H. United States Department of Justice:
1. 2010 ADA Standards for Accessible Design.

1.3 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Installation Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop

Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Coordinate sizes and locations of concealed framing and blocking to ensure that doorstops and other wall-mounted items have sufficient backing as required for proper performance.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: For power, signal, and control wiring. Include the following:
      a. Details of interface of electrified door hardware and building safety and security systems.
      b. Schematic diagram of systems that interface with electrified door hardware.
      c. Point-to-point wiring.
      d. Risers.
      e. Elevations of doors controlled by electrified door hardware.
   2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: Submit minimum 2-inch by 4-inch plate Samples of each type of finish required, except primed finish.
   1. Submit full size Sample of exposed door hardware of each type as directed by Architect in specified finish. Tag with full description for coordination with door hardware sets. Submit Samples before, or concurrent with, submission of final door hardware sets.
      a. Full size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit final door hardware sets at earliest possible date, particularly where approval of door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Format: Comply with scheduling sequence and vertical format in DHI Handbook "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page. Use same door numbers as in Contract Documents.
3. Content: Include the following information:
    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Location of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Type, style, function, size, quantity, and finish of each door hardware item.
    d. Complete designations, including name and manufacturer, type, style, function, size, quantity, and finish of each door hardware product.
    e. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
        i) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
    f. Fastenings and other pertinent information.
    g. Explanation of abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for door hardware.
    i. List of related door devices specified in other Sections for each door and frame.

E. Keying Schedule: Prepared by or under supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For electrified door hardware, from the manufacturer.
1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Installer shall have warehousing facilities in Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Architectural Hardware Consultant shall also be a certified Electrified Hardware Consultant.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Keying Conference: Conduct conference at Project site to comply with Division 1 requirements for project meetings. In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security representative or consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials. Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 FIELD CONDITIONS

A. Existing Openings: Where new hardware components are scheduled for installation on existing construction or where modifications to existing door hardware is required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper door operation and maintenance. Refer to requirements for installation of new hardware on existing doors, frames, and opeingings in "Action Submittals" Article.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Periods:
      a. Locksets (non-electrified): 3 years from date of Substantial Completion.
      b. Surface Closers: 10 years from date of Substantial Completion.
      c. Exit Devices: 3 years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Means of Egress Doors: Comply with NFPA 101. Locks do not require use of a key, tool, or special knowledge for operation. Latches do not require more than 15 lbf to release the latch.

E. Accessibility Requirements:

1. Comply with applicable provisions of the following:
    a. California Building Code (Title 24, Part 2), Chapters 11A and 11B.
    b. United States Department of Justice's 2010 ADA Standards for Accessible Design.
2. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
3. Comply with the following maximum opening-force requirements:
    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    c. Exterior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    d. Fire Doors: Minimum opening force allowable by authorities having jurisdiction, but not to exceed 15 lbf.
4. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
5. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

2.2 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Manufacturer and product designation are listed for each door hardware type required. Manufacturer's names are abbreviated in Part 3 "Door Hardware Sets" Article.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1, Grade 1.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors; wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.4 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: BHMA A156.17, Grade 1.

2.5 CENTER-HUNG AND OFFSET PIVOTS

A. Center-Hung and Offset Pivots: BHMA A156.4, Grade 1.

2.6 CONTINUOUS HINGES

A. Standard: BHMA A156.26, Grade 1.

B. Continuous Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.7 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As scheduled in Part 3 "Door Hardware Sets" Article.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.

2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch latchbolt throw.

C. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

D. Bored Locks: BHMA A156.2.

E. Mortise Locks: BHMA A156.13.

2.8 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.5; with strike that suits frame.

B. Mortise Auxiliary Locks: BHMA A156.5; with strike that suits frame.

2.9 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31, Grade 1; with faceplate to suit lock and frame.
1. Fire-Rated Door Assemblies: Use fail-secure electric strikes with fire-rated devices.

2.10 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: BHMA A156.25, Grade 1; with strike that suits frame.

2.11 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

C. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

D. Removable Mullions: BHMA A156.3.

E. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

F. Outside Trim: As scheduled in Part 3 "Door Hardware Sets" Article.

2.12 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Number of Pins: Six.
   2. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturer's cylinders.

D. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
      a. Replace construction cores with permanent cores as directed by Owner.

E. Manufacturer: Same manufacturer as for locks and latches.

2.13 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Comply with all keying requirements of Owner.

B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the notation "DO NOT DUPLICATE."
   2. Quantity: In addition to one extra key blank for each lock, provide the following (as applicable):
      a. Cylinder Change Keys: Three
      b. Master Keys: Five
      c. Grand Master Keys: Five
      d. Great-Grand Master Keys: Five

2.14 KEY CONTROL SYSTEM

A. Key Lock Boxes: Designed for storage of two keys.
   1. Manufacturer:
      a. Knox Company (KNX).

2.15 OPERATING TRIM

A. Operating Trim: BHMA A156.6.

2.16 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Astragals: BHMA A156.22.

2.17 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Install surface closer on non-public side of door unless indicated otherwise.
    a. Provide parallel arm closers when located on push-side of door.

B. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

2.18 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Concealed-in-Door Closer: Mortised into top rail of minimum 1-3/4-inch-thick doors and track mortised into head frame; with double lever arm indicated.

C. Concealed Overhead Closer: Mortised into head frame; with cast-metal body and exposed cover plate.

2.19 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: BHMA A156.15, Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by building fire alarm system.

2.20 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.21 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

2.22 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

2.23 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Door Sweeps: Gasket material held in place by flat metal housing or flange; surface mounted to face of door with screws.

C. Door Shoes: Gasket material held in place by metal housing; mounted to bottom edge of door with screws.

D. Automatic Door Bottoms: Gasket material held in place by metal housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

2.24 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.25 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch thick metal as scheduled in Hardware Sets; with manufacturer's standard machine or self-tapping screw fasteners.

B. Kickplates: Height as scheduled in Part 3 "Door Hardware Sets" Article, by door width with allowance for frame stops.

2.26 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16; Grade 1.

B. Silencers for Metal Door Frames: Neoprene or rubber; minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.27 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except

aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Wood or Machine Screws: For the following:
    a. Hinges mortised to doors or frames.
    b. Strike plates to frames.
    c. Closers to doors and frames.
3. Steel Through Bolts: For the following unless door blocking is provided:
    a. Surface hinges to doors.
    b. Closers to doors and frames.
    c. Surface-mounted exit devices.
4. Spacers: for through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
6. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.28 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before stripping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Verify concealed blocking and backing has been installed for all doorstops and other wall-mounted items occurring on framed walls.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI Handbook "Recommended Locations for Architectural Hardware for Flush Wood Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Operating Hardware: Between 30 inches and 44 inches above finish floor, per 2022 California Building Code Section 1133B.2.5.2.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in Part 3 "Door Hardware Sets" Article, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated, or, if not indicated, at nearest accessible concealed space. Verify location with Architect.

G. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

H. Stops: Provide door stops as scheduled in Part 3 "Door Hardware Sets" Article.

1. Do not mount floor stops where stop will impede traffic.

I. Perimeter Gasketing: Apply to head and jambs, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 1 Section for demonstration and training.

3.7 DOOR HARDWARE SETS

A. Items listed in the following Schedule of Door Hardware Sets conform to requirements specified in Part 2 of this Section.

B. Manufacturer's Abbreviations:

MK - McKinney

PE - Pemko
RF - Rixson
BM - Besam
SU - Securitron
RO - Rockwood
SA - SARGENT
MC - Medeco
NO - Norton

C. Hardware Sets:

HW Set 01

Doors X101, X102, X103

Qty.	Item	Product	Mfr.	Finish
2	Elec Power Transfer	EL-EPTL	SU	
1	Exit Device	NB 55 56 AD8610 EO	SA	US32D
1	Exit Device	NB 55 56 60 AD8610 106	SA	US32D
1	LFIC Core	322401H GMK	MC	26
2	Door Pull	RM3311-72 Mtg- 12XHD MP	RO	US32D
1	Concealed Closer/Pivot	93N 90N	RF	626
1	Single Door Operator/Pivot	SW200i OHC (SGL)	BM	689
1	Threshold	271A (or per details)	PE	
1	Gasketing	by door mfg.		
2	Frame Harness	QC-C1500P (as required)	MK	
2	Door Harness	QC-C____P (as required)	MK	
2	ADA Push Plate Actuator	639	NO	
1	Power Supply	AQL Series (as required)	SU	

HW Set 02

Doors 103, 104

Qty.	Item	Product	Mfr.	Finish
1	Pivot Set	117-3/4	RF	630
2	Push Plate	70C	RO	US32D
2	Kick Plate	K1050 10"	RO	US32D

END OF SECTION 08 71 00

SECTION 08 81 00

GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Glass for the following glazed systems:
      a. Aluminum entrance and storefront systems.
      b. Hollow-metal doors and frames.
      c. Wood windows.
   2. Glazing sealants, tapes, and other accessories.

B. Related Sections include:
   1. Section 08 41 13 "Glazed Aluminum Entrances" for aluminum storefront and entrance systems to receive glazing, and associated glazing gaskets.

1.2 REFERENCES

A. American Architectural Manufacturer's Association (AAMA):
   1. AAMA GDSG-1: Glass Design for Sloped Glazing.
   2. AAMA TIR-A7: Sloped Glazing Guidelines.
   3. AAMA 800: Voluntary Specifications and Test Methods for Sealants.

B. Architectural Glass & Metal Technician (AGMT) Certification Program.

C. ASTM International:
   1. ASTM C920: Standard Specification for Elastomeric Joint Sealants.
   2. ASTM C1021: Standard Practice for Laboratories Engaged in the Testing of Building Systems.
   3. ASTM C1036: Standard Specification for Flat Glass.
   4. ASTM C1048: Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT, Coated, and Uncoated Glass.
   5. ASTM C1087: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   6. ASTM C1172: Standard Specification for Architectural Laminated Flat Glass.
   7. ASTM C1281: Standard Specification for Preformed Tape Sealants for Glazing Applications.
   8. ASTM E1300: Standard Practice for Determining Load Resistance of Glass in Buildings.
   9. ASTM C1330: Standard Specification for Cylindrical Sealant Backing For Use With Cold Liquid-Applied Sealants.

10. ASTM E2190: Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.

E. California Department of Public Health (CDPH):

1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

F. Code of Federal Regulations (CFR):

1. 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
2. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.

G. Insulating Glass Certification Council (IGCC).

H. Insulating Glass Manufacturer's Alliance (IGMA):

1. IGMA TB-3001: Guidelines for Sloped Glazing.
2. SIGMA TM-3000: North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

I. Lawrence Berkeley National Laboratory (LBNL):

1. WINDOW 5.2 computer program.

J. National Fenestration Rating Council (NFRC):

1. NFRC 100: Procedure for Determining Fenestration Product Thermal Properties.
2. NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
3. NFRC 300: Procedures for Determining Solar Optical Properties of Simple Fenestration Products.
4. NFRC CAP 1: Certification Agency Program.

K. National Glass Association (NGA) with GANA (Glass Association of North America):

1. Glazing Manual.
2. Laminated Glazing Reference Manual.

L. Safety Glazing Certification Council (SGCC).

M. South Coast Air Quality Management District (SCAQMD):

1. Rule 1168 – Adhesive and Sealant Applications.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit.

D. VOC: Volatile Organic Compound.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

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

B. Samples for Verification: For the following products, in the form of 12-inch square Samples for glass.
   1. Vision glass.
   2. Each type of laminated glass.
   3. For each color (except black) of exposed glazing sealant indicated.

C. Glazing Accessory Samples: For each color of exposed tapes, gaskets, and glazing sealants, in 12-inch lengths.

D. CALGreen Submittals:
   1. Manufacturer's product data for glazing sealants and primers indicating compliance with product requirements specified in "CALGreen Requirements" Article.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

F. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer.
2. Manufacturers of fabricated glass units.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: For tests performed by a qualified testing agency, for the following:
1. Laminated glass.
2. Insulating glass.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Insulating-Glass and Laminated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units that is approved by primary glass manufacturers.

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glazing technicians for this Project who are certified under the Architectural Glass and Metal Technician (AGMT) certification program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build glass mockups by installing scheduled glass in mockups specified in the following Sections to match glazing systems required for Project, including glazing methods.
a. Section 08 41 13 ”Glazed Aluminum Entrances and Storefronts.”
b. Section 08 52 00 “Wood Windows.”
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test not fewer than four Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

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

1.12 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain all tinted glass from single source from single manufacturer, unless indicated otherwise.
2. Obtain coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer for each product and installation method.

2.2 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide glazing sealants and primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

2.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Engage a qualified professional engineer to confirm that indicated glass thicknesses are capable of withstanding the effects of the following within limits and under conditions determined in accordance with ASTM E1300 and California Building Code, Chapter 24:

1. Wind loads and stresses calculated based on requirements of the California Building Code, using factors defined therein and applicable to local site conditions and specific project parameters.
    a. Wind Speed: As per California Building Code, as determined by project location and Risk Category of building.

i) Risk Category: III

b. Include wind uplift effects in calculations.

2. Snow Loads: Not less than snow loads applicable to Project as required by California Building Code.

C. Probability of Breakage:

1. Glazing Not More Than 15 Degrees From Vertical Plane: Not greater than 8 lites per 1000.

a. Load Duration: 3 seconds.

2. Sloped Glazing More Than 15 Degrees From Vertical: Not greater than 1 lite per 1000.

a. Load Duration: 30 days.

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

E. Maximum Lateral Deflection: Not more than that required to maintain glazing edge support, and as required to comply with California Building Code, Chapter 24.

F. Safety Glazing: Where tempered or laminated glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

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

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

H. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.

2. For laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq ft x deg F.

5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.

6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Glazing Manual," and "Laminated Glazing Reference Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark safety glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction, or of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Glass Thicknesses: Glass thicknesses indicated are minimums. Provide glass that complies with specified performance requirements and is not less than thickness indicated.

1. Thickness of Tinted Glass: Provide same thickness of tinted glass throughout project for each tint color indicated.

E. Strength: Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.5 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. Kind: Kind FT (fully tempered).
3. Condition: Comply with requirements for uncoated and coated glass as follows:
    a. Uncoated Vision Glass: Condition A.
    b. Coated Vision Glass: Condition C.
4. Type: Type I (transparent flat glass).
    a. Class:

i) Where Clear Glazing is Indicated: Class 1 (clear).

ii) Where Tinted Glazing is Indicated: Class 2 (tinted).

-Tint Color: As indicated in Glass Schedules at end of this Section.

5. Quality: Q3.

B. Heat-Strengthened Float Glass: ASTM C1048.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. Kind: Kind HS (heat strengthened).
3. Condition: Comply with requirements for uncoated and coated glass as follows:
   a. Uncoated Vision Glass: Condition A.
   b. Coated Vision Glass: Condition C.
4. Type: Type I (transparent flat glass).
   a. Class:
      i) Where Clear Glazing is Indicated: Class 1 (clear).
      ii) Where Tinted Glazing is Indicated: Class 2 (tinted).
         a) Tint Color: As indicated in Glass Schedules at end of this Section.
5. Quality: Q3.

C. Monolithic Glass Types: Refer to "Monolithic Glass Schedule" at end of this Section.

2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Glass Plies: Comply with applicable requirements in "Glass Products" Article.
3. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
4. Interlayer Color: Clear unless indicated otherwise.

B. Laminated Glass Types: Refer to "Laminated Glass Schedule" at end of this Section.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of

service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Glazing Sealant: Single-component, nonsag, neutral-curing silicone glazing sealant; ASTM C920, Type S, Grade NS, Class 50 minimum, Use NT (exposure), Use G, A, O (joint substrate)

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; 795 Silicone Building Sealant.
   b. Momentive Performance Materials, Inc./GE; SCS2000 SilPruf.
   c. Pecora Corporation; 895.
   d. Tremco Incorporated; Spectrem 2.
   e. Equal product in accordance with Division 1 requirements for product substitutions.
2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below (AAMA standards referenced below are contained within AAMA 800):

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types (AAMA standards referenced below are contained within AAMA 800):

1. AAMA 810.1, Type I, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Elastomeric material with Shore, Type A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Elastomeric material with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Framing System Glazing Stops and Gaskets:

1. Hollow-Metal Steel Frames: Refer to Section 08 11 13 "Hollow-Metal Doors and Frames" for removable glazing stops.
2. Aluminum Storefront Systems: Refer to Section 08 41 13 "Glazed Aluminum Entrances and Storefronts" for pressure-glazing system with gaskets.
3. Aluminum Curtainwall Systems: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls" for pressure-glazing system with gaskets.
4. Aluminum Windows: Refer to Section 08 51 13 "Aluminum Windows" for snap-in glazing stops.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components as specified in "Performance Requirements" Article.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, and then to jambs. Cover horizontal framing joints by applying tapes to jambs, and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant, where applicable.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter-cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than 4 work days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type GL-1: Clear float glass.
   1. Thickness: 6.0 mm.
   2. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings or by historical requirements.
   3. Provide safety glazing labeling as required.

3.9 LAMINATED-GLASS SCHEDULE

A. Glass Type GL-2: Clear laminated glass.
   1. Overall Thickness: 12.00 mm (±1/2 inch).
   2. Construction:
      a. Outer Ply: Clear heat-strengthened float glass.
         i) Thickness: 6.00 mm (±1/4 inch).
      b. Interlayer: 0.060 inch clear PVB.
      c. Inner Ply: Clear heat-strengthened float glass.
         i) Thickness: 6.00 mm (±1/4 inch).
   3. Provide safety glazing labeling.
   4. Optical and Thermal Properties:
      a. Visible Light Transmittance: 85 percent.
      b. Solar Heat Gain Coefficient: 0.72 maximum.
      c. Shading Coefficient: 0.82.
      d. Winter Nighttime U-Factor: 0.97 maximum.
      e. Summer Daytime U-Factor: 0.87 maximum.
   5. Thermal Properties:
      a. Winter Nighttime U-Factor: 0.46 maximum.
      b. Summer Daytime U-Factor: 0.49 maximum

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Gypsum board.

2. Texture finishes.

3. Cutting and patching of existing gypsum board.

1.02 RELATED SECTIONS

A. Section 07 84 50 "Fire-Resistive Joint Systems" for head-of-wall assemblies at fire-rated walls that incorporate gypsum board.

B. Section 09 22 16 "Cold-Formed Non-Structural Metal Framing" for non-structural cold-formed metal framing and accessories, including interior partition walls, furring, framed soffits, and ceiling joists that support gypsum board.

C. Section 09 91 00 "Painting" for primers and finish coats applied to gypsum board surfaces.

1.03 REFERENCES

A. ASTM International:

1. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

3. ASTM C 475: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

4. ASTM C 645: Standard Specification for Nonstructural Steel Framing Members.

5. ASTM C 834: Standard Specification for Latex Sealants.

6. ASTM C 840: Standard Specification for Application and Finishing of Gypsum Board.

7. ASTM C 919: Standard Practice for Use of Sealants in Acoustical Applications.

8. ASTM C 954: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.112 inch in Thickness.

9. ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

10. ASTM C 1047: Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

11. ASTM C 1396: Standard Specification for Gypsum Board.

12. ASTM C 1629: Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

13. ASTM C 1658: Standard Specification for Glass Mat Gypsum Panels.

14. ASTM D 3273: Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

15. ASTM D 3274: Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation.

16. ASTM E 90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

17. ASTM E 119: Standard Test Methods for Fire Tests of Building Construction and Materials.

18. ASTM E 413: Classification for Rating Sound Insulation.

B. California Department of Public Health (CDPH):

1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

C. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.

D. Gypsum Association (GA):

1. GA-214: Recommended Levels of Gypsum Board Finish.

E. Leadership in Energy & Environmental Design (LEED) Version 4 (v4), United States Green Building Council:

1. LEED v4 BD+C: New Construction and Major Renovations.

2. LEED v4 BD+C: Retail.

3. LEED v4 BD+C: Hospitality.

F. South Coast Air Quality Management District (SCAQMD):

1. Rule 1168 – Adhesive and Sealant Applications.

G. UL Environment:

1. GREENGUARD Gold certification program.

1.04 DEFINITIONS

A. STC: Sound Transmission Class.

B. VOC: Volatile Organic Compound.

1.05 SUBMITTALS

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

B. Samples for Verification: For the following products:

1. Reveal Molding Trim: Full-size Sample in 12-inch-long length for each reveal molding trim indicated.

2. Textured Finishes: 12 by 12-inch sample of each textured finish on same backing indicated for Work.

C. CALGreen Submittals:

1. Manufacturer's product data for sealants and laminating adhesives, indicating compliance with product requirements specified in "CALGreen Requirements" Article.

D. LEED v4 Submittals:

1. EQ Credit: Low-Emitting Materials:

a. Product data for each type of gypsum board product, indicating compliance with testing and product requirements specified in "LEED v4 Requirements" Article.

b. Product data for each type of sealant and laminating adhesive, indicating compliance with requirements specified in "LEED v4 Requirements" Article for the following:

1) VOC emissions of adhesives occurring inside the weatherproofing system.

a) State exposure criteria used to determine compliance.

b) State range of total VOC's after 14 days (336 hours), measured as specified in CDPH Standard Practice for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1.

c) For wet-applied products, state amount applied in mass per surface area.

2) VOC content of adhesives occurring inside the weatherproofing system.

E. INFORMATIONAL SUBMITTALS

1. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall assemblies incorporating sound isolation clips.

1.06 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 50 square feet in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wall-coverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed and integrated into adjacent surfaces at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, surface contamination, corrosion, construction traffic, and other potential causes of damage. Stack gypsum panels flat and supported on risers on a flat platform to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads or trim.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written insructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide acoustical sealant and primer, and gypsum board laminating adhesive which complies with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

2.02 LEED v4 REQUIREMENTS

A. VOC Emissions of Gypsum Board: Provide gypsum board that complies with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

B. VOC Emissions of Acoustical Sealant and Laminating Adhesives: Provide adhesives used inside the weatherproofing system that comply with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

C. VOC Content of Acoustical Sealant and Laminating Adhesives: Provide adhesives, including primers, used inside the weatherproofing system that comply with applicable VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.03 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.04 GYPSUM BOARD

A. Gypsum Panel Sizes: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Board: Type X, ASTM C 1396.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Georgia-Pacific Gypsum LLC; ToughRock Fireguard X.

b. National Gypsum Company; Gold Bond Fire-Shield Gypsum Board.

c. USG Corporation; SHEETROCK Brand Firecode X Gypsum Panel.

d. Equal product in accordance with Division 1 requirements for product substitutions.

2. Thickness: 5/8 inch.

3. Long Edges: Tapered.

4. VOC Emissions: Complying with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

    a. Certification: UL Environment; GREENGUARD Gold.

C. Moisture- and Mold-Resistant Gypsum Board: Type X, ASTM C 1396.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Georgia-Pacific Gypsum LLC; ToughRock Fireguard X Mold-Guard.

    b. National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board.

    c. USG Corporation; SHEETROCK Brand Mold Tough Firecode X Panel.

    d. Equal product in accordance with Division 1 requirements for product substitutions.

2. Thickness: 5/8 inch.

3. Long Edges: Tapered.

4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

5. VOC Emissions: Complying with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

    a. Certification: UL Environment; GREENGUARD Gold.

D. Impact-Resistant Gypsum Board: Type X, ASTM C 1396 for paper-faced gypsum board, and ASTM C 1658 for Glass-Mat-Faced Gypsum Board.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Georgia-Pacific Gypsum LLC; DensArmor Plus Fireguard Impact-Resistant Interior Panel.

    b. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.

    c. USG Corporation; SHEETROCK Brand Mold Tough VHI Firecode X Panel.

    d. Equal product in accordance with Division 1 requirements for product substitutions.

2. Thickness: 5/8 inch.

3. Long Edges: Tapered.

4. Surface Abrasion: ASTM C 1629, meets or exceeds Level 2.

5. Indentation: ASTM C 1629, meets or exceeds Level 1.

6. Soft-Body Impact: ASTM C 1629, meets or exceeds Level 3.

7. Hard-Body Impact: ASTM C 1629, meets or exceeds Level 2.

8. VOC Emissions: Complying with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

    a. Certification: UL Environment; GREENGUARD Gold.

2.05 SOUND ISOLATION CLIPS

A. General: Manufacturer's mounting clip for securing hat channel furring away from face of framing member to provide acoustical isolation between gypsum board and framing member. Clip designed to securely hold standard 7/8-inch deep metal hat channel within resilient rubber housing.

1. Product: Subject to compliance with requirements, provide the following:

    a. Kinetics Noise Control, Inc.; IsoMax.

2. Provide sound isolation clips that, when incorporated into the following wall assemblies, result in the indicated ratings, as determined by ASTM E 413 when tested according to ASTM E 90:

    a. One layer of 5/8 inch gypsum board at each side of 2x4 studs at 16 inches on center with fiberglass batt insulation: STC 57.

    b. Two layers of 5/8 inch gypsum board at each side of 2x4 studs at 16 inches on center with fiberglass batt insulation: STC 63.

3. Design Load Capacity: Pullout force of hat channel from clip shall meet the following minimum values, when tested in a horizontal orientation (e.g. ceiling) with load applied downward:

    a. 25 Gage Hat Channel: 36 lbs.

    b. 22 Gage Hat Channel: 48 lbs.

2.06 TRIM ACCESSORIES

A. Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

2. Shapes:

    a. Cornerbead: Type with face flange to receive joint compound.

    b. LC-bead: J-shaped; exposed long flange receives joint compound.

    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

    d. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Reveal Molding Trim: Extruded accessories of profiles and dimensions indicated.

1. Profiles:

a. Reveal Molding: 3/4 inch wide by 5/8 inch deep; double-flange.

1) Product: Fry Reglet Corporation; DRM-625-75.

b. Reveal Molding: 2 inches wide by 5/8 inch deep; double-flange.

1) Product: Fry Reglet Corporation; DRM-625-200.

c. "F" Reveal Molding: 3/4 inch wide by 5/8 inch deep; single-flange.

1) Product: Fry Reglet Corporation; DRMF-625-75.

d. "Z" Reveal Molding: 1/2 inch wide by 5/8 inch deep; single-flange.

1) Product: Fry Reglet Corporation; DRMZ-625-50.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.

3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.07 JOINT TREATMENT MATERIALS

A. General: Provide materials complying with ASTM C 475 and the recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.

B. Joint Tape:

1. Paper-Faced Gypsum Board: Paper.

2. Glass-Mat-Faced Gypsum Board: 10-by-10 threads per inch glass-fiber mesh of type recommended by glass-mat-faced gypsum board manufacturer.

C. Joint Compound for Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.

4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.08 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 inch (22 gage) to 0.112 inch (12 gage) thick.

C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0346 inch (20 gage), unless indicated otherwise.

2. Protective Coating: ASTM A 653, G60 (Z180).

3. Depth: 7/8 inch, unless indicated otherwise.

D. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical, with face attached to single flange by a slotted leg (web).

E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

b. USG Corporation; SHEETROCK Brand Acoustical Sealant.

c. Equal product in accordance with Division 1 requirements for product substitutions.

2. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.

3. VOC Emissions: Complies with requirements specified in "LEED v4 Requirements" Article.

F. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.

2. VOC Emissions: Complies with requirements specified in "LEED v4 Requirements" Article.

G. Sound Attenuation Blankets: As specified in Section 07 21 00 "Building Insulation."

H. Thermal Insulation: As specified in Section 07 21 00 "Building Insulation."

2.09 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish.

1. Texture: Fine.

2. Products: Subject to compliance with requirements, provide one of the following:

   a. National Gypsum Company; ProForm Perfect Spray.

   b. USG Corporation; SHEETROCK Brand Ceiling Spray Texture, QT Poly.

   c. Equal product in accordance with Division 1 requirements for product substitutions.

C. Non-Aggregate Finish: Premixed, unaggregated texture finish for spray application.

1. Texture: **[Light spatter] [Spatter knock-down] [Orange peel].**

2. Products: Subject to compliance with requirements, provide one of the following:

   a. National Gypsum Company; ProForm Wall & Ceiling Spray.

   b. USG Corporation; SHEETROCK Brand Wall and Ceiling Spray Texture.

   c. Equal product in accordance with Division 1 requirements for product substitutions.

D. Acoustical Finish: Refer to Section 09 83 16 "Sprayed Acoustical Material" for sprayed-on material with sound absorption properties applied to gypsum board surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine gypsum board panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CUTTING AND PATCHING

A. Cut, patch, replace, and repair existing gypsum board surfaces as necessary to accommodate other work, including installation of concealed conduits and backing in existing wall cavities, and to remove dents and other imperfections, and restore surface to specified finish levels.

B. When cutting out sections of existing gypsum board areas, cut gypsum board along supporting framing members.

C. When patching and infilling existing gypsum board areas, produce invisible joint between existing and new surfaces. Match existing gypsum board finish.

3.03 APPLYING AND FINISHING GYPSUM BOARD PANELS

A. Comply with ASTM C 840.

B. Where indicated, install sound attenuation blankets and thermal batt insulation in accordance with requirements of Section 07 21 00 "Building Insulation," before installing gypsum board panels, unless blankets are readily installed after panels have been installed on one side.

1. Place insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions and tight to items passing through ceilings.

C. Install Type X gypsum board panels at all locations. [except as follows:]

1. Moisture- and Mold-Resistant Gypsum Board: **Kitchen and Back of House.**

D. Install ceiling gypsum board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

E. Install gypsum board panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

F. Locate panel edges and end joints over continuous supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

1. Attach gypsum board panel edges to framing provided at perimeter of openings and cutouts.

G. Form control and expansion joints with space between edges of adjoining gypsum board panels.

H. Cover both faces of stud partition framing with gypsum board panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 square feet in area.

I. Attachment to Cold-Formed Metal Framing: Attach gypsum board panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges, first.

J. Wood Framing: Install gypsum board panels over wood framing, with floating internal corner construction. Do not attach gypsum board panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float panels over these members, or provide control joints to counteract wood shrinkage.

K. Fit gypsum board panels around ducts, pipes, and conduits.

L. Where partitions intersect open concrete coffers, concrete joists and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum board panels to fit profile formed by coffers, joists, and other structural members; allow 1/4 to 3/8-inch wide joints to install sealant.

M. Isolate perimeter of gypsum board panels applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

1. Refer to Section 07 84 50 "Fire-Resistive Joint Systems" for head-of-wall joint systems at fire-rated partitions.

N. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above suspended ceilings.

1. Install resilient furring channels in accordance with manufacturer's written instructions.

2. Install sound isolation clips in accordance with manufacturer's written instructions.

O. Space fasteners in gypsum board panels according to referenced gypsum board application and finishing standard and manufacturer's written instructions.

P. Single-Layer Application:

1. On ceilings, apply gypsum board panels before wall/partition gypsum board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum board panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of gypsum board panels.

3. On Z-furring members, apply gypsum board panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

4. Fastening Methods: Apply gypsum board panels to supports with steel drill screws.

Q. Multi-Layer Application:

1. On ceilings, apply gypsum board panels indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board panels indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistive-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one framing member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

R. Laminating to Substrate: Where gypsum board panels are indicated as directly adhered to substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

S. Curved Partitions:

1. Install gypsum board panels horizontally (perpendicular to framing) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.

2. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum board panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches on center.

3. For double-layer construction, fasten base layer to studs with screws 16 inches on center. Center gypsum board face layer panels over joints in base layer, and fasten to framing with screws spaced 12 inches on center.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated, according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Install trim as follows:

1. Cornerbead: Use at outside corners.

2. LC-Bead (J-Bead): Use at exposed panel edges.

3. Curved-Edge Cornerbead: Use at curved openings.

D. Install reveal molding trim at locations indicated on Drawings.

3.05 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to GA-214 "Recommended Levels of Gypsum Board Finish."

1. Gypsum board to receive paint finish, and as indicated otherwise: Level 5.

a. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, followed by skim coat over entire surface.

2. Gypsum board to receive flat paint finish or vinyl wall covering: Level 4.

a. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

3. Gypsum board occurring behind tackable panels, acoustical panels, and impact-resistant wall covering: Level 3.

a. Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges.

4. Gypsum board in concealed locations: Level 1 (except as required otherwise by listed designs for fire and sound construction).

a. Embed tape at joints.

3.06 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum board and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.07 PROTECTION

A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet or moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 64 29

WOOD FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Factory-finished wood flooring.

1.2 REFERENCES

A. ASTM International (American Society for Testing and Materials):

1. ASTM D 4397: Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
2. ASTM D 4869: Specification for Asphalt-Saturated Organic Felt Shingle Underlayment Used in Roofing.
3. ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
4. ASTM F 1869: Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

B. Code of Federal Regulations (CFR):

1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.

C. Forest Stewardship Council (FSC):

1. FSC STD-01-001: FSC Principles and Criteria for Forest Stewardship.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show plans and installation details including location and layout of each type of wood flooring and accessory. Include expansion provisions and trim details.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors and finishes available for wood flooring stain/sealer.

1. Minimum Number of Colors for Selection: 15.

D. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Flooring: Equal to ***[1]*** percent of amount installed for each type of wood flooring indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body."

C. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.

D. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.

E. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of at least 16 square feet for each type of species, grade, cut, and finish indicated.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

D. Move wood flooring into spaces where it will be installed, at least 7 days before installation.

1.7 PROJECT CONDITIONS

A. Conditioning period begins not less than 7 days before wood flooring installation, is continuous through installation, and continues not less than 7 days after wood flooring installation.

1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.

2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
    a. Do not install flooring until it adjusts to relative humidity of, and is at the same temperature as, space where it is to be installed.
    b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 - PRODUCTS

2.1 FACTORY FINISHED WOOD FLOORING

A. Engineered-Wood Flooring: HPVA EF, complying with requirements for composite wood
    1. Basis of Design: Provenza Affinity Collection
        a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

B. Species: European Oak

C. Thickness: ½ inch.

D. Construction: Engineered.

E. Face Width: 7.48 inches.

F. Length: Up to 82.67 inches.

G. Edge Style: Beveled (eased).

H. Finish: Prefinished with a stain and low-VOC satin polyurethane.

I. Color: Engage

2.2 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils thick.

B. Asphalt-Saturated Felt: ASTM D 4869, Type II.

C. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
    1. VOC Content: Provide adhesive that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).

a. In addition to local regulatory limits, 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).

D. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.

E. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."

F. Cork Expansion Strip: Composition cork strip.

G. Flooring transitions: as indicated on drawings.

H. Trim: In same species and grade as wood flooring, unless otherwise indicated.

1. Base: Per drawings.
2. Thresholds and saddles: To match wood flooring. Tapered on each side.
3. Reducer Strip: 2 inches wide, tapered on one side, and in thickness matching wood flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
2. For adhesively applied wood flooring, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of wood products.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.

c. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximimum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.

1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Concrete substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Adhesion Testing: Perform tests recommended by wood flooring manufacturer. Proceed with installation only after substrates pass testing.

D. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with flooring manufacturer's written instructions, but not less than recommendations in NWFA's "Installation Guidelines: Wood Flooring," as applicable to flooring type.

B. Pattern: Lay wood flooring in pattern indicated on Drawings or, if not indicated, as directed by Architect.

C. Expansion Space: Provide expansion space at walls and other obstructions and terminations of flooring as recommended by manufacturer of wood flooring.

1. If not concealed by trim, fill expansion space with flush cork expansion strip.

D. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:

1. Wood Flooring Installed Directly on Concrete: Install a layer of polyethylene sheet according to flooring manufacturer's written instructions.

E. Engineered-Wood Flooring: Set in adhesive.

F. Wood Trim: Nail baseboard to wall and nail shoe molding or other trim to baseboard; do not nail to flooring.

3.4 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 096723

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Resinous flooring system with urethane body.
    a. Application Method: Metal, power or hand troweled.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
2. Review details of integral cove bases.
3. Review manufacturer's written instructions for installing resinous flooring systems.
4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.
5. Attendance:

    a. Contractor.
    b. Architect.
    c. Owner representative.
    d. Manufacturer/installer representative.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches square, applied to a rigid backing by Installer for this Project.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each resinous flooring component.

C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
2. Contractor shall have completed at least 10 projects of similar size and complexity.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch square floor area selected by Architect.

    a. Include 96-inch length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Store material per product data sheet.

C. Factory pre-weighed and pre-package materials used in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

1. Maintain material and substrate temperature between 65 and 85 deg F during resinous flooring application and for not less than 24 hours after application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Concrete substrate shall be properly cured. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.8 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing in accordance with Class 1, ASTM D648.

B. System Physical Properties: Provide a resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Elongation: 200% per ASTM D412.
2. Tensile Strength: 1,200 psi per ASTM D412.
3. Hardness: 70, Shore D per ASTM D2240.
4. Abrasion Resistance: 0.06 gm per ASTM D4060, CS-17
5. Water Absorption : 0.1% per ASTM C413

2.2 SYSTEM DESCRIPTIONS

A. System Characteristics:

1. Color and Pattern: As indicated in a schedule on Drawings.
2. Wearing Surface: Standard smooth.
3. Base: Integral cove with trim.
4. Overall System Thickness: Nominal 1/8 inch to 1/4 inch.

2.3 RESINOUS FLOORING

A. Basis-of-Design Manufacturer:

1. Stonhard, Inc.; Stongard UR® unsealed system.

B. System Characteristics:

1. Wearing Surface: Texture TBD.
2. Integral Cove Base: As indicated on Drawings.
3. Overall System Thickness: 1/4 inch.

C. System Components: Manufacturer's standard components that are compatible with each other and as follows:

1. Primer Coat:

a. Color and Pattern: As selected by Architect from manufacturers standard colors.
b. Wearing Surface: Standard smooth metal troweled, unsealed.

1) Resin: Urethane.
2) Formulation Description: Four component 100 percent solids. Low VOC.
3) Application Method: Squeegee back roll.
4) Number of Coats: One.

2. Morat Base::

a. Material Design Basis: Stongard UR®.
b. Resin: Polyurethane.

1) Formulation Description: 100 percent solids.
2) Application Method: Metal trowel.

a) Thickness of Coats: 1/4 inch.
b) Number of Coats: One.

3) Aggregate: Quartz pigmented blended aggregate.

2.4 INTEGRAL COVE BASE, EXB-01. EXB-02, EXB-03, EXB-04

A. Radius Cove: Cove molding with approximately 1-inch radius for adhesive installation at floor-to-wall joint as substrate to receive resinous flooring system to form an integral cove base.

2.5 ACCESSORY MATERIALS

A. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated.

1. Formulation Description Only:

a. If application above grade Stonproof ME7.
b. Must include texture 3 to ensure intercoat adhesion.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

1. Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean and dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Mechanically prepare substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup or Diamond Grind with a dust free system.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates meet the following requirements.

a. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours.
b. No moisture testing needs to be conducted on a new concrete slab with a vapor retarder.
c. If the concrete is existing, and experiencing moisture related issues, than testing should be conducted to quantify the extent of the issue.

1) Perform in situ probe test, ASTM F2170. Proceed with application only after substrate does not exceed a maximum of 85 percent relative humidity.
or
2) Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours

d. Drains located in areas exhibiting thermal shock should be treated with a sealant type recommended or produced by resinous flooring manufacture for type of service and joint condition indicated. Allowances should be included for Stonflex MP7 joint fill material.

4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

    a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Stonclad UR mortar, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners.

1. Integral Cove Base: Height at indicated on Drawings.

D. Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

E. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Comply with manufacturer's recommendations for protective materials and method of application. Where temporary covering is required for this purpose. Contractor is responsible for protection.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General Contractor is responsible for cleaning prior to inspection.

END OF SECTION

SECTION 09 96 00

HIGH-PERFORMANCE COATING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Application of special coating systems to items and surfaces scheduled, including surface preparation, prime coats and topcoats.

B. Related Requirements:

1. Section 051200 “Structural Steel Framing: Shop preparation and priming of exposed structural steel.

C. Surfaces Not To Be Coated:

1. Factory prefinished items including finished metal surfaces.

1.2 DEFINITIONS

A. Definitions of Painting Terms: ASTM D16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical information, including basic materials analysis and application instructions, for each coating material specified. Include manufacturer's recommendations for mixing, thinning and curing.

1. List each material and cross-reference the specific coating and finish system and application.
2. Identify each material by the manufacturer's catalog number, product trade name, and general classification.
3. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application

B. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped samples defining each separate coat, including block fillers and primers. Resubmit samples as requested until required sheen, color and texture are achieved.
2. Provide a list of material and application for each coat of each finish sample. Label each sample as to location and application.
3. Submit samples on following substrates for Architect's review of color and texture only:
   a. Provide two 8-inch long samples of solid metal for each type of color and finish.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Provide products for each specified function and finish system from one source and of a single manufacturer.

B. Manufacturer’s Qualifications:

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Applicator:

1. Experienced in application of required coatings and approved by manufacturer for their application.

D. Material Quality: Provide the best quality grade of the various coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

E. Coordination of Work:

1. Review specification sections in which other coatings are provided to ensure compatibility of the total systems for various substrates.
2. Upon request, furnish information on characteristics of specified finish materials, to ensure that compatible prime coats are used.
3. Notify the Architect of problems anticipated using the coatings systems specified.

F. Manufacturer Assistance: Obtain review of proposed coating systems by manufacturer, and ensure that manufacturer's authorized representative is available to advise applicator on proper application techniques and procedures.

G. Preapplication Meeting: Convene a preapplication meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer’s representative. Review the following:

1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
3. Surface preparation.
4. Application.
5. Repair.
6. Field quality control.
7. Cleaning.
8. Protection of coating systems.
9. One-year inspection.
10. Coordination with other work.

1.5 DELIVERY, STORAGE AND HANDLING

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

1. Name or title of material.
2. Manufacturer's name, stock number and date of manufacture.

3. Contents by volume, for major pigment and vehicle constituents.
4. Thinning instructions.
5. Application instructions.
6. Color name and number.
7. Handling instructions and precautions.

B. Store materials in protected, well ventilated area at an ambient temperature between 45 degrees F and 110 degrees F.

1. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
2. Keep storage area neat and orderly; remove oily rags and waste daily.

C. Take necessary precautionary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying the coatings.

1.6 PROJECT CONDITIONS

A. Apply coatings only when the temperatures of surfaces to be coated and of surrounding air are above 50 degrees F and not above 100 degrees F, unless otherwise permitted by manufacturer's printed instructions.

B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions.

C. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

D. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and the temperature within the area can be maintained within limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. System Type: Epoxy/Fluorourethane:

1. QUV - ASTM D 4141, Method C (EMMAQUA):
   a. No blistering, cracking or chalking. No less than 79% gloss retention, no more than 9 units gloss loss and no more than 0.45 DEHunter color change (white) after 3,500 MJ/m2 (128,951 MJ/m2 total) EMMAQUA exposure.
2. QUV - ASTM D 6695 Xenon Arc Weathering:
   a. No blistering, cracking or chalking. No less than 90% gloss retention (2.4 units gloss change) and no greater than 0.20 DE00 color change (beige) after 8,000 hours Xenon Arc exposure. (TR5972).
3. Flexibility & Elongation - ASTM D 522 (Method A, Conical Mandrel):
   a. No less than 12.80% elongation, average of three tests.
4. Cleanability - MIL-PRF-85285D Section 4.6.13:
   a. No less than 99% cleaning efficiency, average of two tests.

2.2 MANUFACTURERS

A. Products specified are manufactured by Tnemec Company Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372, 1 (800)-TNEMEC-1, www.tnemec.com, and are specified as a standard of quality. Local Contact: TNW Inc. 206-762-5755.

B. Equivalent materials of other manufacturers may be substituted upon approval by Architect of manufacturer's product data and certified test reports showing that substitute products equal or exceed performance of specified products.

1. Porter International (Porter).
2. Valspar Corporation (Valspar).

2.3 COATING SYSTEMS FOR EXTERIOR STAINLESS STEEL - SEVERE MARINE EXPOSURE

A. Aggressive Corrosion, Coastal, or UV Exposure, Physical Abuse:

1. System Type: Epoxy/Fluorourethane:

a. Surface Preparation: SSPC-SP-1 Solvent Cleaning
b. Shop or Field Primer: Series 1224 Epoxoline WB, DFT 3.0 to 5.0 mils.
c. Shop or Field Intermediate: Series 1095 Endura-Sheild, 3.0 to 5.0 mils.
d. Total DFT: 8.0 to 13.0 mils.

B. Color: As indicated on Drawings.

2.4 ACCESSORIES

A. Accessories required for application of specified coatings in accordance with manufacturer’s instructions, including thinners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which coatings will be applied for compliance with requirements on applying coatings.

1. Surfaces to receive coatings must be thoroughly dry before coatings are applied.
2. Do not proceed with coating application until unsatisfactory conditions have been corrected.
3. Start of application will be construed as the Applicator's acceptance of surfaces within particular area.

B. Coordinating Work: Review sections in which other coatings are provided to ensure compatibility of the total systems for various substrates.

1. On request, furnish information on the characteristics of specified finish materials to ensure compatible primers.
2. Notify the Architect of problems anticipated using the coatings specified over substrates primed by others.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer’s instructions.

B. Ensure surfaces are dry.

C. Exterior Surfaces: Remove visible oil, grease, dirt, and other contaminants per SSPC-SP1.

3.3 MATERIAL PREPARATION

A. Carefully mix and prepare materials according to the coating manufacturer's directions.

B. Maintain containers used in mixing and application of coatings according to the manufacturer's directions.

C. Stir materials before applying to produce a mixture of uniform density; stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain the coating material before using.

D. Use only type of thinners approved by the coating material manufacturer and only within recommended limits.

E. Material Life:

1. Do not use materials beyond manufacturer's recommended shelf life.
2. Discard and do not use mixed materials beyond manufacturer's recommended pot life.

F. Tinting: Tint each undercoat a lighter shade to facilitate identifying each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.4 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer’s instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer’s instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.5 REPAIR

A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer’s instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.6 INSPECTION

A. Request inspection and acceptance of each coat before applying succeeding coats.

B. Remove, and refinish or recoat work not complying with specified requirements.

3.7 CLEANING

A. Clean-Up: At the end of each work day, remove rubbish, empty cans, rags, and other discarded materials from the site.

B. Remove paint spatters from glass, fixtures, and adjoining surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or damage adjacent finished surfaces.

3.8 PROTECTION

A. Protect work of other trades, whether to be coated or not, against damage from coating.

1. Correct damage by cleaning, repairing, replacing, and recoating as acceptable to Architect.
2. Leave in an undamaged condition.

B. Provide "Wet Paint" signs to protect newly coated finishes.

C. After completion of coating operations, remove temporary protective wrappings provided by others for protection of their work.

D. At completion of construction activities, touch up and restore damaged or defaced surfaces.

3.9 WASTE MANAGEMENT

A. Separate and recycled waste materials.

1. Coatings: Water based, allowing for water clean up. Use of kerosene or any such organic solvents to thin or clean up water based paints is prohibited.
2. Collect waste coatings by type and provide for delivery to recycling or collection facility.
3. Place waste cans in designated containers for proper disposal as promulgated by the Utah Department of Environment Quality.

3.10 FIELD QUALITY CONTROL

A. Inspector’s Services:

1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application are as specified.
3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.

4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.

    a. Check for holidays on interior steel immersion surfaces using holiday detector.

5. Report:

    a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
    b. Report nonconforming work not corrected.
    c. Submit copies of report to Architect and Contractor.

B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.11 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.12 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.13 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturers instructions.

END OF SECTION

SECTION 21 10 00

WATER BASED FIRE SUPPRESSION SYSTEM

PART 1 - GENERAL

1.01 PURPOSE

A. The Design-Builder is seeking proposals from qualified Subcontractors for completion of the design and installation of fire protection systems for the Fisherman's Wharf Forwater Street Public Plaza.

B. In addition to installing the systems, the selected Subcontractor for this project will collaborate with the Architects, Engineers, General Contractor and his Sub-contractor in a "design-build" project delivery approach to complete the design of the systems required for this project. Under this contract arrangement, the Engineer is responsible for establishing design criteria, systems to be provided, and overall standards for utility and quality. The selected Subcontractor will complete the final design, and will provide details, construction drawings, and means and methods of construction to be incorporated in order to provide systems within the established budget. The Subcontractor shall include in their bid all work necessary for preparation of final details and construction shop drawings, and participation in team meetings for refinement of the design and coordination with other trades. The purpose of this Section is to define the scope of work upon which the Fire Sprinkler Subcontractors, hereafter known as Subcontractor(s), are to base their bids, establish the design criteria, and to define design submittals which will be required.

1.02 DESIGN BUILD SUMMARY

A. This specification section outlines the requirements for wet based fire suppression systems. The work described in this specification includes all engineering, labor, materials, and equipment and services necessary to design, install and test the fire protection system in accordance with NFPA 307, 2022 Edition, and NFPA 13, 2022 Edition.

1. The following is included:

a. Demolition of existing fire sprinkler systems under the wharfs.

b. Automatic wet sprinkler systems.

c. Pipe settlement joints.

B. The drawings are at a design level and are intended to indicate only the basis of design and general scope of work required for the project, but do not show all specific elements or details of the work necessary for complete installation of the systems. The Contractor shall identify, and include in their bid, all materials, labor, tools, instructions, data, testing, reports, spare parts, and services required to design and install complete and functional fire protection systems in accordance with the Contract Documents.

C. Provide any apparatus, appliance, material or other work not specifically shown on the drawings but mentioned in the specifications, and vice-versa, necessary to make the work complete in all respects, ready for operation and to perform in the manner indicated. These items shall be incorporated in the design, furnished, and installed without additional expense to SFIA, even if not specifically specified.

D. Furnish labor, materials, testing, tools, equipment, services, and transportation necessary for, or reasonably incidental to, the construction and completion in working order of the fire protection work. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the Contract Documents shall be provided and incorporated at no additional cost to SFIA. Work includes, but is not limited to, the following:

1. The design and installation of hydraulically calculated automatic wet fire sprinkler systems for the wharf substructure within the project areas including connection to existing fire water supply and backflow prevention

2. Provide complete product submittals for all fire protection equipment and materials.

3. Provide coordinated Shop Drawings of the automatic wet fire sprinkler systems in Revit®, 2022 using architectural and structural backgrounds, hydraulic calculations, seismic sway bracing calculations, equipment anchorage calculations and details.

4. Provide complete as-built drawings of the fire sprinkler system in Revit®, 2022 using architectural and structural backgrounds. Drawings shall include exact locations of piping, sprinkler heads, sprinkler control valve assemblies, pipe supports, seismic bracings, and other fire sprinkler equipment.

5. Obtain system approvals and pay for necessary permits and fees.

6. Testing and adjusting of completed work, inspections and instructions. Inspections, testing and maintenance work required by NFPA 25 and recommended by the equipment manufacturer shall be provided. Work shall include operation of sprinkler system alarm and supervisory devices.

7. Repair of damage done to premises as a result of this installation and removal of debris left by those engaged in this installation.

8. Excavation, trenching and backfill required in this section of work.

9. Deferred approval requirements: Contractor shall submit fire sprinkler plans, seismic sway bracing details and calculations, and hydraulic calculations to Port's Fire Marshal and Port's Building Department and obtain necessary approvals for the fire sprinkler.

1.03 DESCRIPTION OF BID DOCUMENTS

A. Specifications:

1. Specifications, in general, describe quality and character of materials and equipment.

2. Specifications are of simplified form and include incomplete sentences.

3. Words or phrases such as "the Contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" may have been omitted for brevity.

B. Drawings:

1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.

2. Scaled and figured dimensions are approximate and are for estimating purposes only.

3. Before proceeding with work check and verify all dimensions.

4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.

5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

6. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts.

1.04 MINOR DEVIATIONS

A. The Drawings are diagrammatic and show the general arrangements of all fire protection work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this section.

B. The Contractor shall carefully review and study the structural and architectural conditions affecting all of their work, and it is the specific intention of this section that all such work imposed on this section by structural and architectural conditions of the Contract shall be borne by this section at no extra cost to Port.

C. The Contractor shall study the operational requirements of each system, and shall arrange their work accordingly, and shall furnish such fittings, offsets, traps, valves, supports, accessories, as required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the "Electrical Work". Should cases arise where physical conflict occurs because of the absence of part or all of these sections, coordination is a responsibility of the Contractor; the time delay, the labor and materials, and any other item of cost for time shall not be at a cost to Port, including demolition.

D. Minor deviations to avoid conflicts shall be permitted where the design intent is not altered.

E. Advise Port’s Representative, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise SFIA of the conflict.

1.05 RELATED WORK SPECIFIED ELSEWHERE

A. Section 099013, Exterior Painting.

B. Division 26, Electrical.

1.06 REFERENCE AND STANDARDS

A. Regulatory compliance: Work performed under this division shall comply with the latest currently adopted editions of codes and regulations. The following references and standards are hereby made a part of this section and Work shall conform to applicable requirements herein except as otherwise specified herein or shown on the Drawings.

B. Codes, Standards, Laws and Orders: Conform to applicable codes, standards, laws and orders as stated herein and as described in Division 1 of the Specifications, including but not limited to the following:

1. California Building Code, 2022 Edition.

2. California Fire Code, 2022 Edition.

3. California Code of Regulations (CCR), Titles 8, 17, 19, 20, 21 and 24.

4. NFPA Codes and Standards (currently adopted editions).

5. Safety and Health Regulations for Construction of U.S. Department of Labor, OSHA and California OSHA.

6. All applicable laws and regulations and standards of FAA, including airfield security requirements.

7. The Americans with Disability Act (ADA) requirements for disabled access.

C. In addition to previously mentioned, work shall comply with the following:

1. NFPA 307-Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharfs.

2. NFPA 13 - Standard for the Installation of Sprinkler Systems, 2022 Edition.

3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2022 Edition.

4. NFPA 25 - Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems, 2022 California Edition.

5. NFPA 51B – Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, 2022 Edition.

6. NFPA 70 - National Electric Code, 2022 Edition.

7. NFPA 72 - National Fire Alarm Code, 2022 Edition.

8. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations, 2022 Edition.

D. In addition to the above, all construction shall be done in conformance with rules, regulations, and requirements established by the San Francisco Fire Department relating to the safety and convenience of the public, to the safeguarding and protection of property, and to operations.

E. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work of this section where cited by abbreviations noted below. Comply with the currently adopted editions of applicable standards:

1. ANSI - American National Standard Institute.

2. ASME - American Society of Mechanical Engineers.

3. ASTM - American Standards for Testing and Materials.

4. AWS - American Welding Society.

5. AWWA - American Water Works Association.

6. FAA - Federal Aviation Administration.

7. ICBO - International Conference of Building Officials.

8. OSHA - Occupational Safety & Health Administration.

9. NACE - National Association of Corrosion Engineers.

10. NBS - National Bureau of Standards.

11. NEMA - National Electrical Manufacturer's Association.

12. NCPWB - National Certified Pipe Welding Bureau.

13. NFPA - National Fire Protection Association.

14. UL - Underwriters Laboratories.

F. Minimum requirements: The requirements of these Specifications are the minimum that will be allowed, unless such requirements are exceeded by applicable codes or regulations, in which the local regulatory code or regulation requirement of this competition shall govern.

G. Nothing in the Specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained in writing from the legally constituted authorities having jurisdiction and the SFIA's Representative.

1.07 WORK RESPONSIBILITIES

A. Site Conditions:

1. Examine the Drawings and the Specifications, survey the existing site conditions, and include necessary allowances in bid proposal.

2. Resolve conflicts with code requirements, site conditions, the work of other trades, or other mechanical contractors.

3. Verify the location of existing utilities prior to construction and protect from damage.

4. Pay costs incurred due to damage of existing utilities or other facilities.

B. Drawings:

1. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of their work, furnishing the necessary piping, fittings, valves, and other devices which may be required to complete the installation.

2. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the architectural, structural, mechanical and electrical drawings and the work of other trades prior to installation of piping and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Port's Representative for approval. Only when the Port's

Representative approval is given in writing, shall Contractor proceed with installation of the work. Any changes with deviate from the approved plan shall be submitted to the SFFD for review and approval.

3. In case of a difference in the Specifications or between the Specifications and the drawings, the Contractor shall figure the most stringent and most expensive alternate and after award of contract, shall secure direction from the Port's Representative.

4. Bring discrepancies between different drawings, between drawings and actual field conditions or between drawings and Specifications, promptly to the attention of the Port's Representative for decision.

5. Clearances and Openings: Contractor shall cooperate and coordinate their work with other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to their requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the Specifications, and shall include recesses, chases in walls, and required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

6. The architectural Drawings and Specifications take precedence over the fire protection drawings for location of casework, equipment, lights, diffusers, plumbing fixtures, and other building components. Contractor shall comply with the requirements of the Drawings, Specifications, and review Shop Drawings for work, in order to coordinate their work with the other work of the Project.

7. Scaled and figured dimensions are approximate and are given for estimate purposes only. Before proceeding with any work, carefully check and verify dimensions and sizes.

8. Drawings are diagrammatic and size and locations of equipment are generally shown to scale. Make use of data in Contract Documents, and informational documents, and verify this information against field conditions.

9. As far as possible, the work has been indicated on the drawings in such positions as to suit and accommodate the work of the other trades, but the work as indicated is largely diagrammatic and is shown primarily for clarity. Contractor is responsible for the correct placing of their work and the proper location and connection of their work in relation to the work of other trades.

10. Where apparatus and equipment have been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. Carefully check the drawings to see that the equipment will fit into the spaces provided.

11. Where equipment is furnished by another Division, verify dimensions and the correct locations of this equipment before proceeding with the rough-in of connections.

C. Responsibility:

1. Contractor shall route the combination standpipe lines and fire sprinkler lines above finished ceilings to maintain the ceiling heights and clearances established in the Contract Documents. Contractor shall not make penetrations in structural framing without prior approval of SFIA's Representative. Submit proposed locations and sizes for beam penetrations to SFIA's Representative for approval at least 15 working days prior to planned work associated with the penetrations.

2. Be responsible for cooperative work which must be altered due to lack of proper supervision or failure to make proper provision in time. Such changes shall be directly supervised by the Port’s Representative and shall be made to their satisfaction.

3. Provide complete functioning systems and include labor, material and associated tools and transportation required for the system to operate safely and satisfactorily.

4. Provide work indicated on the drawings whether or not specifically mentioned in the Specifications.

5. Coordinate the installation of fire protection items with the schedules for work of other trades and other contractors to prevent delays in total work. Assume responsibility for cooperative work which must be altered due to lack of proper supervision or failure to make proper provisions in time.

6. Be specifically responsible for ensuring that coordination between the fire sprinkler system work and the fire detection and alarm system work takes place to ensure full awareness of the location of fire sprinkler system components requiring connection to the fire detection and alarm system. These components include but are not limited to; control valves, flow switches, supervisory switches and alarm bells.

1.08 PERMITS, LICENSES AND INSPECTIONS

A. Obtain and pay for permits, fees and inspections required by work under this Section.

B. Inspections: Work shall be regularly inspected by the authority having jurisdiction. Coordinate on site inspections with the SFIA’s Representative for the Project so that there is unified communication about each system and required changes or improvements. Certificates of approval shall be delivered to the SFIA’s Representative. Be responsible for notifying the authority having jurisdiction when work is ready for inspection.

1.09 SERVICE CONNECTIONS

A. Certain site utilities are to be extended and connected to. Before installing pipe or digging of trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which is to be connected. In event depth of lines is not sufficient to permit connection in manner indicated; Contractor shall obtain direction from the Port’s Representative before proceeding with this work. Coordinate interfacing of building piping and site piping with the site utilities contractor.

1.10 QUALITY ASSURANCE

A. Qualifications:

1. For the actual installation, and testing of work under this section, use only thoroughly trained and experienced work personnel completely familiar with the items required and the manufacturer's current recommended methods of installation.

2. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill.

3. The execution of the work shall be in strict accordance with the best practice of the trades, the intent of this specification, and codes and ordinances.

B. Contractor's Qualifications: A firm with at least five (5) years of successful installation experience on projects with fire protection systems work similar and of comparable size and scope to that required for this Project. Contractor shall be prepared to submit written evidence of the installer's experience. Only a licensed fire-protection engineering contractor shall do installation of the entire sprinkler and standpipe systems, and shall have at least five (5) years experience in designing and installing sprinkler and standpipe systems. The Contractor shall possess a valid and current State of California C-16 Contractor's license, and shall have held this license under the currently-licensed business name, for a period of not less than five (5) years as of the date of bidding the Project and regardless of whether any other license classification is also held. Contractor shall also be capable of providing on-site emergency service within four hours of notification. The Contractor shall also be capable of providing drawings in Autocad® Revit®, 2022 using architectural and structural backgrounds.

1. Exception: Responsibility for the exterior underground portion of the system may be delegated to a (A) General Contractor, (C-34) Pipeline Subcontractor, or (C-36) Plumbing Subcontractor, otherwise qualified as above. The contractor to whom the work is delegated shall be responsible for the portion of the system from the point of connection to the site or public water supply system to a point six inches (6") above the finished floor of the structure. The fire sprinkler contractor will still be responsible for the hydraulic calculations and coordination of piping interfacing.

C. Manufacturer's Qualifications, Products and Product Listing:

1. Materials and equipment installed as part of this work shall be new, and the manufacturer's current model. Piping components, equipment, valves and other devices shall be UL listed and/or FM approved for fire sprinkler use.

2. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.

3. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 100 miles of the Project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the Project): pumps, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.

4. Items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

5. The products and execution of work specified in Division 21 shall conform to the referenced codes and standards by the Specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities. If the local codes are more stringent, then the local code shall apply. Conflicts shall be brought to the attention of the Port's Representative.

6. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall compatible.

7. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

8. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

9. Asbestos products or equipment or materials containing asbestos shall not be used.

D. Welded Joints: Weld in accordance with procedures established and qualified per ANSI B31.2. Each welder and welding operator shall be qualified for the ANSI procedures as evidenced by a copy of a certified ANSI B31.2 qualification test report. Contractor shall conduct the ANSI qualification test. Sprinkler piping shall be shop welded except where allowed by NFPA 13 & NFPA 15. A hot work permit for on-site welding/brazing/soldering shall be obtained from the SFIA Fire Marshal, and as required by NFPA 51B prior to the commencement of any site hot work.

E. Qualifications of Welders: Welders and procedures used for work in this section shall be certified to the requirements of ASME Section 9. Certification shall be within the last five (5) years. The Contractor shall provide the SFIA’s Representative with the names of welders employed in the work, together with certification that each of these welders has passed qualification tests as prescribed by the National Certified Pipe Welding Bureau, or other testing laboratory or agency approved by the SFIA’s Representative.

F. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be compatible.

G. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the SFIA’s Representative prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

H. Execution (Installation, Construction) Quality: All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and Specifications shall be referred to the SFIA’s Representative for resolution. Written hard copies or computer files of manufacturer’s installation instructions shall be provided to the SFIA’s Representative at least two weeks prior to commencing installation of any item.

1.11 INSTALLATION

A. Bring to the Port’s Representative’s attention prior to installation, conflicts with other trades which will result in unavoidable contact to the equipment and piping, described herein, due to inadequate space.

B. Bring to the Port’s Representative’s attention, discrepancies between the Specifications and field conditions, changes required due to specific equipment selection, prior to installation.

C. Provide written notification to the SFIA’s Representative a minimum of fourteen (14) days prior to a utility shut down.

D. Obtain inspection and approval from the Port’s Representative of any installation to be covered

or enclosed prior to such closure.

E. Restoration of Damage: Repair or replace, as directed by Port's Representative, materials and parts of premises which become damaged as result of installation of work of this Division. Remove replaced parts from premises.

F. Prior to installation work, the Contractor shall obtain approvals from Port's Fire Marshal.

1.12 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during and after installation and to protect the installed work and materials of other trades.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Port's Representative.

C. Protection of Materials and Equipment:

1. Protect materials, equipment and apparatus as specified in this Division from damage, water, dust, or similar impairment, both in storage and installation until Notice of Completion has been filed. Materials, equipment or apparatus damaged because of improper storage or protection will be rejected and must be removed from site.

2. Pipes shall be delivered to the site with wrapped ends.

3. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.

4. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Port has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against damage.

5. Damaged equipment shall be replaced with an identical unit as determined and directed by Port's Representative. Such replacement shall be at no additional cost to the Port.

6. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.

7. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected same as for new work.

D. Cleanliness of Piping Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.

2. Piping systems shall be flushed in accordance with NFPA.

3. Contractor shall be fully responsible for costs, damage, and delay arising from failure to provide clean systems.

1.13 REVIEW OF CONSTRUCTION

A. The Port's Representative may review work at any time.

B. Advise the Port's Representative in advance that work is ready for review at following times:

1. Prior to backfilling buried work.

2. Prior to concealment of contract items that has been completed.

3. When requirements of Contract have been completed.

4. Prior to installation of suspended dry wall and ceiling.

C. Do not backfill or conceal work without the Port's Representative's consent, any prior to Port Fire Marshal.

D. Maintain on job a set of Specifications and drawings for use by the Port's Representative.

E. Noncompliance: Should any of the work be covered up or enclosed prior to required inspections and approvals, uncover the work as needed and, after it has been completely inspected and approved, make repairs and replacements with such materials as are necessary to the approval of the Port's Representative and at no additional cost to the Port.

1.14 SYSTEM ACCEPTANCE

A. Final Review: Request a final review prior to system acceptance after:

1. Completion of the installation of systems required under the Contract Documents.

2. Submission and acceptance of operating and maintenance data.

3. Completion of pipe and valve identification.

4. Satisfactory operation of systems for a period of one (1) week.

5. The Port Fire Marshal's and Port's final inspection and acceptance.

B. Acceptance shall be contingent on:

1. Completion of final review and correction of deficiencies.

2. Satisfactory completion of the acceptance tests which shall demonstrate compliance with performance and technical requirements of the Contract Documents.

3. Submission of as-built drawings.

4. The Port's Fire Marshal's and Port's final acceptance of the system.

C. Certificate of Occupancy:

1. Building shall not be occupied until the authority having jurisdiction has issued a certificate of occupancy to the Port's Representative. Issuance of a certificate of occupancy shall not be construed as an approval of any violation of a Code or Port's design standard or criteria.

1.15 DAMAGE BY LEAKS

A. Be responsible for damage to any part of the premises caused by leaks in the pipe or equipment installed under applicable section for a period of twelve (12) months from the date of acceptance of the work by the Port.

1.16 SUBMITTALS

A. Submit Shop Drawings and product data in accordance with Section 013300 "Submittals" and this section. Submittals shall comply with the requirements of SFFD AB2.04. Contractor shall submit the fire sprinkler Shop Drawings and hydraulic and seismic bracing calculations to Port's Fire Marshal and Port only after the Port's Representative have reviewed the documents.

B. Manufacturers' submittal literature and shop drawings are required on items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Port's Representative submittal notes are a part of the work of this Division except that Port's Representative notes may not be used as a means of increasing the scope of work of this Division.

C. Submittals will be checked for general conformance with the design concept of the Project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

D. Product Data:

1. Submit manufacturer's product brochures for products. Written descriptions of products are not acceptable. Furnish, all at one time, prior to installation, valid submittal data on material, equipment and devices.

2. Manufacturer's specifications, data sheets, certified drawings, and installation instructions. Include physical and performance data such as weights, sizes, capacities, required clearances, performance curves, acoustical characteristics, finishes, color selection, and accessories.

3. All product data shall be submitted in the following formats:

a. Electronic copies: Product data in "PDF" format submitted on a USB flash drive.

4. To be valid, all product submittals must:

a. Identify Project name and location, Contractor's, Subcontractor's, supplier's or manufacturer's name, address, and telephone number.

b. Identify manufacturer's name and model numbers. All catalog cut sheets must identify (Colored Highlights or Arrows) as to the specific make and model number and any options provided of all components. Manufacturer's cut sheets showing multiple components/models must have the unused items crossed out.

c. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

d. Include all pertinent construction, installation, performance and technical data.

e. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly

marked.

1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

2) Product data sheets corresponding to items indicated in Specifications shall be clearly labeled with the specification section, and item numbers.

f. Identification of deviations from Contract Documents. All revisions shall be clouded.

g. Identification of revisions on re-submittals.

h. A blank space for Contractor and Port's Representative stamps.

i. Contractor's stamp, initialed or signed, certifying review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

5. Submit product data and brochures for, but not limited to the following:

a. Pipe material and fittings.

b. Pipe corrosion protection.

c. Valves (all types).

d. Zone and inspector's test alarm modules.

e. Backflow preventer.

f. Pipe supports including seismic bracing.

g. Settlement joints.

h. Sleeves and escutcheons.

i. Fire stopping, including UL listing system numbers and details.

j. Pressure gauges.

k. Water flow switches, including CSFM listing number.

l. Valve supervisory switches, including CSFM listing number.

m. Pipe identification, valve tags and equipment signs.

n. Sprinkler heads, each type and model; and spare sprinkler head cabinets.

o. Fire department connections.

E. Shop Drawings:

1. General: Prepare and submit plans, sections, details and diagrams to required scales for specified areas. Drawings shall be prepared using Revit®, 2022 using architectural and structural backgrounds. Drawings shall be coordinated, dimensioned and indicate equipment and pipes in relation to architectural and structural features. Include minor piping, drains, etc. Indicate exact locations and elevations of valves, piping specialties, access doors, and other protection system related items.

2. Required Drawings: Prepare and submit drawings for fire protection work. Scale shall be a minimum 1/8"=1'-0". Use of Contract Documents for Shop Drawings is not acceptable.

3. Shop drawings shall be submitted in the following formats:

   a. Electronic copies: Shop drawings in "PDF" format.

4. Drawings shall be detailed in accordance with NFPA 13 and 307. Shop Drawings shall indicate accurate locations of piping, standpipes, sprinkler heads, seismic braces, pipe anchors and hangers, drain locations, inspector test connections, and other apparatus associated with these systems in respect to architectural conditions, structural conditions, lighting layouts, diffuser layouts, plumbing, mechanical, and electrical layouts. Plans shall include necessary engineering features, including hydraulic reference nodes, pipe lengths and pipe diameters as required by the above named code and standards. Complete, accurate legends for symbols and abbreviations shall be provided on plans. Drawings shall have the same scale and same sheet size used by the other trades to facilitate coordination. Sprinkler Shop Drawings shall be coordinated with architectural drawings for head locations. Wall and ceiling changes occurring prior to the submittal of contractor's Shop Drawings shall be incorporated into the Contractor's detailed design at no additional contract cost. Sprinkler Shop Drawings shall be stamped and signed by a Mechanical Engineer licensed in the State of California. Shop Drawings shall also be stamped with Contractor's C-16 stamp.

5. Complete and detailed Shop Drawings of a scale larger than the design documents shall be maintained throughout the coordination and construction phase indicating equipment trades' work clearly. Equipment including piping shall clearly identify both top and bottom elevations as well as distances from equipment to established building lines. Coordinate with other trades and field conditions and show dimensions and details including building construction and access for servicing.

F. Certificates:

1. Submit final inspection certificates signed by governing authorities. Submit the following certificates:

   a. Certificate of Installation: Submit in triplicate, certificate upon completion of fire protection piping work, which indicates that work has been tested in accordance with NFPA 13 and NFPA 24; and also that system is operational, complete, and has no defects.

   b. Port's Fire Marshal's and Port's approvals of system.

   c. Final inspection certificate signed by governing authorities.

   d. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures.

e. Others as specified herein and as required.

2. Certificates shall be submitted in the following formats:

a. Electronic copies: "PDF" format.

G. Calculations:

1. Calculations shall be submitted in the following formats:

a. Electronic copies: "PDF" format.

2. Hydraulic Calculations: Hydraulic calculations shall be executed on standard 8½ x 11 inch sheets, conforming to the requirements of NFPA 13, and shall indicate pipe numbers, sizes, lengths, beginning, and end node points, referenced Shop Drawings, and system demand curves. Calculations shall be accomplished using an approved computer program based on the Hazen-Williams formula. Hydraulic calculations shall be stamped and signed by C-16 Contractor licensed in the State of California. The Engineer shall be the same person responsible for the sprinkler Shop Drawings and seismic sway bracing calculations. Calculations shall also be stamped with Contractor's C-16 stamp. Hydraulic calculation shall also include source of water flow information. Calculations shall extend to the point at which the water supply data was determined.

3. Seismic Sway Bracing and Anchorage Calculations: Fire protection piping shall be adequately restrained to resist seismic forces in accordance with NFPA 13. Equipment anchors shall be designed for Seismic Design Category D, with a value of SDS equal to 1.5g. Seismic calculations, restraint selections, and installation details, shall be stamped and signed by a Structural Engineer licensed in the State of California. Calculations shall also be stamped with Contractor's C-16 stamp.

a. Seismic Sway Bracing and Anchorage Load Calculations: The horizontal force factor used in the sway bracing load calculations shall be determined using the method outlined in ASCE 7.05 Chapter 13, Section 1632 by the Registered Structural Engineer of Record for that building. The horizontal force factor determination shall be presented in a letter that is wet stamped and signed with the engineer's P.E. stamp, and the letter shall be provided with the sprinkler system submittal. The sprinkler system submittal drawings shall show a copy of the stamped letter containing the horizontal force factor determination along with the sway bracing load calculations. The sway bracing load calculations shown on the drawings shall indicate the horizontal force factor used, and the load calculations shall account for the weight of the pipe fittings and sprinklers by adding in an additional weight of at least 15% of the calculated load of the pipe.

H. A copy of all the approved fire suppression system drawings and calculations listed above shall be sent to the Architect and Engineer for their records.

1.17 RECORD DRAWINGS

A. Submit in accordance with Section 017839 "Project Record Documents" and this section.

B. Record of Job Progress: Keep an accurate dimensional record of the "As-built" locations of work. This record shall be kept up-to-date on blueline prints as the job progresses and shall be available for inspection at all times. In addition, record drawings are to be used by the Port's Representative for job review and field inspections.

C. "As-Built" documentation shall be transmitted to the Port within ten days after Port’s Representative's acceptance of the completed installation. As-built documentation shall include the following (Unless noted elsewhere, furnish number of copies indicated):

1. One (1) copy of final electronic drawing files.

2. One (1) copy of electronic files in “PDF” format of manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

3. One (1) copy of electronic files in “PDF” format of hydraulic calculations and seismic bracing calculations for each sprinkler system updated to include submittal review comments and any changes to the installations which affect the calculations.

4. One (1) copy of electronic files in “PDF” format of hydrostatic report and NFPA 13 material test certificate for each sprinkler system.

5. One (1) copy of electronic files in “PDF” format of operation and maintenance data updated to include submittal review comments and any equipment substitutions.

6. Manufacturer’s literature, hydraulic and seismic bracing calculations, reports and operation and maintenance data shall be in a labeled three (3) ring binder.

7. Update Revit® 3D model.

1.18 OPERATION AND MAINTENANCE DATA

A. Submit in accordance with requirements of Section 017823 “Operation and Maintenance Data” and this section.

B. The installing contractor shall provide:

1. Literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

2. Publication titled NFPA 25 California 2022 Edition, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

C. Include, but not limited to the following: List of equipment with Manufacturer’s name, model number, and local representative, service facilities and normal channel of supply for each item in electronic “PDF” format.

1. System Description: Description of start-up and operating procedures.

2. Controls: Diagrams and description of operating sequence of each system.

3. Equipment: Manufacturer’s brochures, ratings, certified shop drawings, lubrication charts and data, parts list with parts numbers. Mark each sheet with equipment identification number and actual installed condition.

4. Materials and Accessories: Manufacturer’s brochures parts list with part numbers and lubrication data where applicable. Mark each sheet with equipment identification number or system and location of installation; and to specifically identify which options are provided (in case where data sheet shows multiple options).

5. Certificate of factory tests and code compliance as specified.

6. Recommend preventive maintenance schedule and procedures.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Above Ground Piping and under wharfs:

a. Type 316 Stainless Steel Schedule 40 with stainless steel Victaulic couplings.

B. Below Ground Piping:

1. UL Listed, Class 350 Ductile Iron Pipe (DIP) with mechanical restrained joints: Pipe shall conform to AWWA C151, minimum Class 50. Ductile iron pipes shall be cement mortar lined in conformance with AWWA C104 and shall have a 1-mil thick exterior petroleum asphaltic coating. Pipe shall be of domestic manufacture: U.S. Pipe Tyton joint, Pacific States; or equal. The Contractor shall furnish certification that pipe supplied for this Project has been manufactured in compliance with requirements of AWWA C151.

a. DIP Couplings and Sleeves: Ductile Iron conforming to ANSI/AWWA C 153/A21.53 and shall be 250 psi pressure rated. Couplings and sleeves shall be domestic U.S. Pipe, Tyler, Union, or equal.

b. Ductile Iron and Cast Iron Fittings: AWWA C110, ductile iron or cast iron, 250 psi pressure rating; of dimension to match pipe outside diameter. Fittings to be epoxy coated and lined.

1) Lining: AWWA C104, cement mortar.

2) Gaskets: AWWA C111, rubber.

c. Joints: Joints for ductile pipe shall be of the mechanical or push-on type compression joints unless otherwise indicated, and shall conform to ANSI/AWWA/C111/A21.11, latest revisions. The joint and fittings shall have the same pressure rating as the pipe it shall join. Gaskets and lubricant shall be furnished with the pipe.

d. Mechanical joint restraints shall be "Mega-Lug 1100 Series" by EBBA Iron Sales, MJ Field-Lok by U.S. Pipe, or equal. Joint preparation and installation shall be in accordance with manufacturer's recommendations.

e. Bolts, nuts, washers and rodding used for the installation of underground piping, valves and fittings from the riser flange back to, and including parts of the water main tap shall be stainless steel conforming to UNS31600 (formerly AISI Type 316). Bolts shall conform to ASTM F 593, Alloy Group 2, Condition CW1/CW2 (depending on size). Nuts shall conform to ASTM F 594, Alloy Group 2, Condition CW1/CW2 (depending on size). Individual products not identified by the applicable ASTM standard are not acceptable, regardless of composition. After installation, apply full coat of asphalt or other acceptable corrosion retarding material to surfaces of ferrous anchorages.

C. Unions for piping 2" and smaller, above ground only:

1. Black Steel Pipe: 250 pound screwed black malleable iron, ground joint, brass to iron seat.

2. Galvanized Steel Pipe: 250 pound screwed galvanized malleable iron, ground joint, brass to iron seat.

3. Dielectric Unions: EPCO, or equal, dielectric nut type or flange type unions with gasket material suitable for service and temperature in which they are required. Install at connections between ferrous and non-ferrous piping.

4. Dielectric Waterway Fittings: Victaulic Style 47, or equal, zinc-electroplated steel or ductile iron body with male threaded or grooved ends. LTHS high temperature polyolefin polymer lining suitable for temperatures up to +230 deg F and pressures up to 300 psig. Install at connections between ferrous and non-ferrous piping.

D. Flanges for piping 2½" and larger, above ground only:

1. Raised face 150 pound class forged steel, weld, neck or slip-on type conforming to ASA B16.5 and ASTM A181. The faces of the flanges being connected to be alike in all cases. Locate flanges so that the piping can be easily disconnected for removal of the equipment or valve. Gasket material shall be of material suiting the service of the opening system in which installed and which conforms to its respective ANSI Standard (A21.11. B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

   a. Bolting Materials: Carbon steel Heavy Hex bolts and nuts, ASTM A307-Type B.

   b. Use SBR gasket, 1/16" thick, similar to Garlock No. 91, at flange connections.

2. Dielectric Flange Insulation Kits: Calpico, or equal:

   a. Dielectric Gaskets: 1/8" phenolic, temperature to 225°F, 500 volts per mil dielectric strength, compression strength 24,000 lbs. per sq. inch, water absorbance 1.6% in accordance with ASTM-D-229.

   b. Dielectric Sleeve Material: 1/32" wall spiral would Mylar, 4,000 volts per mil dielectric strength, temperature to 300°F, water absorption 0.8% maximum.

3. Insulating Washers: 1/8" phenolic, same as gasket material.

4. Flange adapters for flanged components to grooved system: Ductile iron housing conforming to ASTM A-536, grade 65-45-12, grade "E" EPDM gasket, Class 125 or 150 bolt-hole pattern. Victaulic Style 741, 744 or equal.

5. Flange adapters for ANSI 300 flanged components to grooved system: Ductile iron housing conforming to ASTM A-536, grade 65-45-12, grade "E" EPDM coupling gasket UL classified in accordance with ANSI/NSF 61 for cold potable water service. Victaulic Style 743, or equal.

6. Provide 300 psi or higher rated fittings where required by the system.

E. Grooved End Fittings:

1. Shall be ductile iron conforming to ASTM A536, short radius, full flow, FireLock® fittings, or standard ductile iron or steel fittings with factory grooved ends designed to accept Victaulic or equal couplings.

2. Rigid Couplings: UL listed and FM approved for use with grooved end connections.

Housings shall have offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer's latest recommendations.

a. 1¼" through 4": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly. Victaulic FireLock® Style 009H, or equal.

3. Flexible Couplings: UL listed for use with grooved end connection. Use in seismic areas and where required by NFPA 13. Victaulic styles 75, 77, 177, or equal.

a. 2" through 8": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly. Victaulic Style 177 QuickVic™, or equal.

4. Victaulic Style 009H, 005, and 07 rigid couplings, or equal, may be used with IPS steel piping systems which meet the support and hanging requirements of NFPA 13. An adequate number of Victaulic Style 177, 75 and 77 flexible couplings, or equal, shall also be used to compensate for thermal expansion/contraction of the pipe.

F. Weld-O-Lets and Thread-O-Lets may be used for non-galvanized steel piping. Welding shall be shop welded by a certified welder. Field (site) welding will not be permitted.

G. Mechanical Tees Style 920 can be used as needed and "Strap-O-Let" type tees are not acceptable unless specifically approved on a case by case basis approved by the AHJ.

H. Prohibited Fittings: XL, POZ-LOK, U-bolt Victaulic style 921 mechanical tees, Victaulic style 99 Roust-A-Bout, Victaulic style 90 Plainlock, Hooker style fitting, quick disconnect, boltless, snap-joint, field drilling or welding of any main or branch lines, and any device specifically prohibited by the local governing agencies is not allowed.

2.02 CORROSION PROTECTION FOR UNDERGROUND PIPE AND FITTINGS

A. In addition, all buried piping, castings, fittings, valves and couplings below ground shall be encased in 8 mil polyethylene tube encasement. Polyethylene wrap shall be manufactured of 0.008 inches (8 mils) minimum, group 2, linear low density, flat tube, polyethylene manufactured of virgin polyethylene material that meets or exceeds the specifications of the latest revision of AWWA C105 and ANSI A21.5, ASTM D4976 and NT4112. Wrappings shall be installed on site only. Minimum properties as follows:

1. Tensile Strength: 3,600 PSI minimum - ASTM D882.

2. Elongation: 800% minimum - ASTM 882.

3. Dielectric Strength: 800 V/mil, minimum - ASTM D149.

4. Impact Resistance: 600g, minimum - ASTM D1709-B.

5. Propagation Tear Resistance: 2550 gf, minimum - ASTM D1922.

6. Density: 0.910 to 0.935 g/cm^3.

B. Color: The polyethylene film shall be black (weather-resistant) containing not less than 2 percent carbon black with an average particle diameter of 50 mm or less. Black Polyethylene

film shall be naturally UV protected.

C. Markings: The polyethylene film supplied shall be clearly marked, at a minimum of every two feet (2') along its length, containing the following verbiage:

1. Manufacturer's Name and Trademark.

2. Year of manufacture.

3. Minimum film thickness and material type.

4. Specification conformance: "ANSI/AWWA C105/A21.5-05.

5. Applicable pipe sizes.

6. Text: "Warning Corrosion Protection - Repair Any Damage".

D. Acceptable Manufacturers:

1. Christy's.

2. Northtown Pipe Protection Products.

3. Trumbull Manufacturing.

4. U.S. Pipe.

5. Or Equal.

2.03 VALVES

A. Gate Valves 2" and Smaller: MSS SP-80; UL listed and FM approved, 175 psi non-shock cold water, bronze body, screw-over bonnet, threaded ends, outside screw and yoke, solid wedge, bronze trim, replaceable seat rings. Provide each valve with supervisory switch. Nibco T-104-O, or equal.

B. Gate Valves 2½" and Larger with Flanged Ends: MSS SP-70; UL listed and FM approved, 175 psi non-shock cold water, iron body, bolted bonnet, flanged ends, outside screw and yoke, solid wedge, pre-grooved stem for supervisory switch mounting, bronze trim, replaceable seat rings. Provide each valve with supervisory switch. Nibco F-607-OTS, or equal.

C. Gate Valves 2½" and Larger with Grooved Ends: UL listed and FM approved, 250 psi CWP, ductile iron body with grooved ends, EPDM coated cast iron disc, brass stem, and cast iron bonnet, Provide each valve with supervisory switch. Victaulic FireLock® Series 771 (OS&Y) and Series 772 (NRS), or equal.

D. Butterfly Valves 2" and Larger: MSS SP-67; UL listed and FM approved, California State Fire Marshal Listed, indicating type, gear operated, ductile iron lug type body, stainless steel stem, nickel plated ductile iron disc, Buena-N seat, 250 psi Non-shock cold water. Provide each valve with a supervisory switch. Nibco LD3510-8, or equal.

E. Butterfly Valves 2" and Larger with Grooved Ends: UL listed and FM approved for indoor and outdoor use, ductile iron body with grooved ends, nickel-plated ductile iron disc, stainless steel bearings with TFE lining, stainless steel stem, Nitrile seat and stem seals. Valve shall have weatherproof actuator with two built-in pre-wired supervisory switches. Victaulic FireLock®

Series 705 (300 psi) and Series 765 (365 psi), or equal, supervised in the open position only.

F. Butterfly Valves 2" and Larger Normally Closed: UL listed and FM approved for indoor and outdoor use, used for fire pump metering test lines per NFPA 20. Weatherproof actuator with pre-wired supervisory switches monitoring the valve in the closed position only. Victaulic FireLock® Series 707C (300 psi) and Series 766 (365 psi), or equal.

G. Ball Valves 2" and Smaller: MSS SP-110; UL listed and FM approved, UL Listed for indoor and outdoor service, California State Fire Marshal Listed, threaded body style, full port design, hand wheel, factory installed internal supervisory switch, bronze body and stem, 300 psi non-shock cold water. Provide each valve with a supervisory switch. Nibco KT-505W-8, or equal.

H. Ball Valves; Inspector's test and drain only-up to 2" maximum: MSS SP-110; UL listed and FM Approved, full or standard port, two piece bronze body construction, chrome plated solid bronze ball, blowout proof stem, and vinyl covered steel handle, 300 psi Non-shock cold water. Nibco KT-580/585-70-UL, or equal.

I. Globe Valves 1" and Smaller: Threaded ends, rubber disc, screw over bonnet, 175 psi non-shock cold water, UL Listed for trim and drain use. Nibco KT-65-UL (straight pattern) or KT-67-UL (angle pattern), or equal.

J. Check Valves 2" and Smaller: MSS SP-80; swing type check valve, screwed bonnet, horizontal swing, renewable disc, bronze body, threaded ends, 200 psi non-shock cold water. Nibco KT-403-W, or equal.

K. Check Valves 2½" and Larger: MSS SP-71; UL listed and FM Approved, swing type check valve, bolted bonnet, horizontal swing, renewable seat and disc, cast iron body, drilled and tapped for ball drip outlet, flanged ends, 175 psi non-shock cold water. Nibco F-908-W, or equal.

L. Check Valves 2½" and Larger at Fire Department Connections: UL listed and FM Approved, ASTM A48 cast iron body, ASTM A240 stainless steel clapper, bronze seat, stainless steel disc and spring actuated, EPDM rubber facing seal and gasket, drilled and tapped for ball drip outlet, grooved ends, 250 lb. WOG. Nibco G-917-W, or equal.

M. Check Valves 2" and Larger with Grooved Ends: Spring-loaded check valves, ductile iron body, stainless steel or EPDM coated ductile iron disc, stainless steel spring, plated nickel seat or welded-in nickel seat, grooved ends. Victaulic FireLock® Series 717H (365 psi) and Series 717 (250 psi), or equal.

N. Drain Valves and Inspector's Test Valves: UL listed, globe, straightway or angle type, ball or butterfly, bronze body, renewable disc, threaded or grooved, 150 lb WOG or 300 psi CWP, equipped with reducer and hose connection with cap or connected to a drain line. Victaulic Style 720 TestMaster™ II, or equal.

O. Automatic Ball Drip Valve: UL listed and FM approved, automatic drain valve horizontally installed at the low point in the fire department connection piping. Water pressure from a fire department pumper automatically closes this valve. Automatically re-opens when pressure ceases, permitting piping to drain and thereby preventing freezing. Bronze body with ¾" or ½" NPT female inlet connection. Maximum working pressure of 175psi. Nibco Model RG22100/22100, or equal.

P. Zone Control Riser Module: UL listed and FM approved zone control riser module installed in zoned wet sprinkler systems, compact design consisting of a ductile iron module body with grooved ends, shutoff valve, test and drain valve combination with different orifice sizes, and

vane type water-flow detector with sealed retard, visual switch activation, and mechanical delay adjustment. Victaulic Series 747M, AGF, or equal.

Q. Reduced Pressure Backflow Detector Assembly: UL listed reduced pressure backflow detector assembly shall consist of OS&Y shut-off valves on inlet and outlet, two independently operating spring loaded check valves, and include accessible test cocks. Furnished complete with ¾" GPM metered by-pass in series with an approved ¾" double check assembly for metering unauthorized water usage. The assembly shall be rated to 175 PSI water working pressure and a temperature range from 33°F to 140°F. Assembly shall be approved for both horizontal and vertical installations. Install at least 12" above floor or ground and in accordance with manufacturer's installation instructions. The assembly shall meet the requirements of ASSE Standard 1015, CSA Certified, IAPMO Listed, AWWA Compliant, UL and C-UL Classified, FM approved and approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California. Backflow prevention devices must be on the approved list of the local Water Department. Backflow preventers shall be tested by certified technician hired by the Contractor and the results submitted to the San Francisco Water Department. Backflow preventers shall be Zurn Wilkins 4-375ADA, or equal.

1. Valves shall be supervised in the open position. Provide tamper switches on the OS&Y valves. Chain and padlock the OS&Y valves in the open position

2.04 FIRE DEPARTMENT CONNECTIONS

1. Fire-Standing Type: Two-way fire department connections, 3'inlets, brass body, polish chrome finish, "AUTO SPKR" lettering, Potter Roemer Model 5762, or equal.

2.05 HANGERS AND SUPPORTS

A. Hangers and seismic sway bracing shall be designed and installed as required by NFPA 13 and by the California Building Code. Provide steel bracing as to resist earthquake loads as required for Seismic Design Category D, with an SDS value of 1.0g. All pipe supports and seismic bracings shall be type 316 stainless steel.

B. Hangers and components shall be U.L. listed and/or FM approved. Hanger and support components including seismic sway bracing components shall be compatible.

C. Hanger Rods: Hanger rod size shall be no less than the standard rod sizes listed on the MSS SP-69. Rods shall be steel rods, Tolco Fig. 103, or equal. Where rod stiffeners are required, use Tolco Fig. 98, or equal.

D. Where beam clamps are used, provide beam clamp retaining strap.

E. Powder-driven and explosive type fasteners are not allowed.

F. Horizontal Pipe Attachments:

1. Adjustable swivel loop hanger, Tolco Fig. 200, or equal.

G. Pipe clamp for sway bracings: Tolco Fig. 4A and 4B pipe clamps, Tolco Fig. 25 surge restrainer, or equal.

H. Sway brace attachments: Tolco Fig. 907 4-way longitudinal sway brace attachment, Tolco Fig. 909 no-thread swivel sway brace attachment, Tolco Fig. 910 swivel sway brace fitting, Tolco Figure 1000 fast clamp, or equal.

I. The end sprinkler on a branch line shall be restrained against excessive vertical and lateral movement by use of a wrap-around hook or by other approved means per NFPA 13.

J. When static pressure exceeds 100 psi, arm over and drops 12" and over requires a hanger. Hanger shall be within 12 inches of drop or sprinkler.

K. Where beam or joist thickness will not accommodate a fastener of a required length, through bolt with the required diameter of the bolt and washer will be acceptable. All thread rods is not acceptable for the required bolt.

2.06 EXPANSION SETTLEMENT JOINTS

A. General: Flexible expansion joints shall be installed in the locations indicated on the drawings and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certification of material shall be readily available upon request.

B. All expansion joints shall be capable of expanding or contracting to the extent required for 12" ground settlement. Expansion unit shall not impart a thrust force while under internal pressure. No periodic maintenance required.

C. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 150 psi for 2 inch (350 psi for flexible expansion joints 3 inch through 12 inches, and 250 psi for 14 inches diameter and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, shall apply. Factory Mutual Approved.

D. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 25º, 2"; 20º, 4" - 12"; 15º, 14+" and 6-inches minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.

E. End Connections: Both standardized mechanical joint (4 inches through 24 inches) and flange end connections (2 inches through 24 inches) shall be available.

F. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be holiday tested with a 1500 volt spark test. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

G. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

H. Appropriately sized polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.

I. Manufacturer's certification of compliance to the above standards and requirements shall be readily available upon request. The purchaser (or owner) shall reserve the right to inspect the manufacturer's facility for compliance.

J. Basis-of-Design Product: Subject to compliance with requirements, provide EBBA Iron, "Forced Balanced Flex Tend"; or equal.

K. When mechanical joints are used: Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraining mechanism shall consist of individually actuated

wedges that increase their resistance to pull-out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial. The joint restrain ring and its wedging components shall be made of Grade 60-42-10 ductile iron conforming to ASTM A536. The wedges shall be ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53. Torque limiting twist off nuts shall be used to insure proper actuation of the restraining wedges. Unit shall have a rated working pressure of 350 psi in sizes sixteen inches and smaller. Devices shall be listed by UL up through the twenty-four inch size and approved by Factory Mutual up through the twelve inch size. Restraint shall be Series 1100 "Megalug", or equal.

2.07 PRESSURE GAUGES

A. U.L. listed and labeled for fire protection sprinkler service, 3½" dial, 0-300 psi scale with 5 psi increments, dual range twice the system working pressure, moisture and weather resistant, ¼" bottom connection, shut-off valve, phosphor bronze tube, and brass socket. Mount pressure gauge on ½", 3-way valves.

2.08 WATER FLOW SWITCHES

A. U.L. listed, California State Fire Marshal listed, and FM Approved, vane type flow switch with retard mechanism or manual adjustment to prevent false alarm, listed for indoor/outdoor use and have tamperproof cover. Provide each with two sets of SPDT contacts and conduit connection for wiring to remote alarm system, Potter Electric Signal Co., VSR, System Sensor WFD Series, or equal. Coordinate installation with Division 26.

2.09 SUPERVISORY (TAMPER) SWITCHES

A. U.L. listed, California State Fire Marshal listed, and FM Approved. Switches shall be listed for indoor/outdoor use, 120 VAC/30 VDC, have tamperproof cover, each with two sets of SPDT contacts and conduit connection for wiring to remote alarm system. Coordinate installation with Division 26.

1. OS&Y gate valves: Switches shall be Potter Electric Signal Co., OSYSU-2, System Sensor OSY2, or equal.

2. Butterfly valves and post indicator valves (PIV): Potter Electric Signal Co., PIVS-U, System Sensor PIBV2, or equal.

3. "Normally Closed" OS&Y valves: Switches shall be System Sensor PSP1 plug-in special purpose supervisory switch, or equal.

2.10 PIPING IDENTIFICATION

A. Piping are to be identified as follows: Brady Perma-Code, MSI Marking Services Inc., or equal, pressure sensitive self-sticking pipe markers consisting of pipe content wording and arrow indicating directions of flow on ANSI color background. Arrow and wording are two separate markers which shall be placed immediately adjacent to each other. Provide at each end of each marker, 2¼" wide self-sticking clear tape around periphery of pipe or insulation to further secure marker. Markers shall be applied to clean surfaces free of dust, grease, oil or any other material which will prevent adhesion. Install after cleaning, painting and insulation is complete. Pipe identification shall comply with ANSI/ASME A13.1 "Scheme for the Identification of Piping Systems" 2007 Standard.

B. Location and visibility for pipe identification:

1. On horizontal main runs spaced 50'-0" maximum but not less than once in each room at entrance and exit of each concealed space.

2. At each riser takeoff.

3. Within 1'-0" of each valve and control device.

4. Where capped piping is provided for future connections, provide legible and durable metal tags indicating symbol identification.

5. At wall and ceiling access panel/doors.

6. Near major equipment items and other points of origination and termination.

7. Pipe identification of sprinkler branch piping is not required.

8. Attention shall be given to visibility with reference to pipe markings. Where pipelines are located above or below the normal line of vision, the lettering shall be placed below or above the horizontal centerline of the pipe.

9. Fire sprinkler mains shall be labeled with the sprinkler zone that it serves. Example: "SZ-1A".

C. Color Coding of Piping:

ANSI Fluid Service	Background Color Field	Color of Text
Fire Protection Water	Red	White
Fire Auto Sprinklers	Red	White
Fire Sprinkler Drain	Red	White

D. Size of Legend Letters:

Outside Diameter of Pipe or Covering	Minimum Length of Color Field	Minimum Size of Text
Less than 2"	8"	¾"
Greater than 2"	12"	1¼"

2.11 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Underground piping shall be identified with underground warning pipe markers as follows as follows: Brady Perma-Code, MSI Marking Services Inc., or equal, non-adhesive four (4) mil polyethylene plastic tape manufactured specifically for warning and identification of buried utility lines. Tape shall be of the type provided in rolls, 6" minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification for lines shall be "CAUTION FIRE PROTECTION WATER LINE BURIED BELOW". Code and letter coloring shall be permanent, unaffected by moisture and other substances contained in trench backfill material.

B. During back-filling of fire line systems, install continuous underground type plastic line markers. Run detector tape continuously along pipe and terminate in adjacent valve boxes or other suitable facilities. No splices will be allowed. Protect tape from damage during installation and backfilling. Tape that is broken, cut or crumpled shall be completely replaced. Install 12" above the top of the respective pipe and 12" below the surface during backfill. Provide detectable type for buried non-metallic pipes.

C. Color Code of underground tape shall be as follows:

ANSI Color Service	Color of Color Field	Color of Text
Fire Protection Water	Red	White

2.12 VALVE TAGS

A. Valves shall have brass identification tag as follows: Brady Perma-Code, MSI Marking Services Inc., or equal, Brass valve identification tag secured with brass chain and "S" hook. Tags shall bear the service identification and numerical identification of the valve.

B. Engrave identification tags with "normally open" (green) or "normally closed" (red).

C. Tags:

1. Minimum 2" square for fire protection.

2. No. 19 BS gauge brass with stamped numbers and letters filled in with black enamel paint. Engraving, ink, dye and vinyl fill are not acceptable.

3. Identifying number and system letter. Top line shall be ¼" characters and should abbreviate the service. Example: Fire Sprinkler - SPR. The second line shall be ½" characters and should list the valve number. Example: 1st floor shall begin 101, second floor shall begin 201.

4. Attach 6"-12" of brass jack chain around bonnet or stem of the valve in a way that it cannot accidentally come off. Attach appropriate size brass "S" hook to the chain in the most conspicuous location. Hang valve tag from the "S" hook. Valve tag should not be attached to the wheel causing interference with valve operation.

5. Provide on: Valves and controls. Tags shall identify the floor and zone served, using sprinkler zone identifiers.

2.13 VALVE AND EQUIPMENT CHARTS

A. Provide five typewritten schedules giving numbers, service and locations, and notations of open or closed, of tagged valves. Enclose each schedule in separate transparent plastic binder. List piping systems with symbol and color coding on pipe identification chart. List valve model numbers and symbol for service corresponding to piping symbol on valve identification chart. Provide small "key plan" identifying valves as related to column lines. Schematic flow diagrams of each piping system indicating:

1. Location and function of each tagged valve.

2. Type, size and essential features of each system.

B. Submit drafts of valve schedule for review before preparing final sets.

C. Frame five copies of reviewed schedule under glass, mount where directed. One copy shall be located in the Fire Command Center (FCC) Room.

D. Provide typewritten list of equipment in triplicate, indicating location, service for each piece of equipment, suitably framed, with glass front.

2.14 IDENTIFICATION SIGNS

A. Provide systems with identification signs as specified and as required by NFPA 13, NFPA 14 and SFIA fire department requirements.

B. Fire sprinkler signs shall be made of 18 gauge minimum baked enamel aluminum and meet NFPA 13. Signs shall be printed red on white background or white on red background. Each sign shall have holes or slots to facilitate field attachment. Signs shall be secured by the use of corrosion-resistant wire, chain, tamper-resistant screws, or other approved means.

2.15 SPRINKLER HEADS

A. General Requirements:

1. Fire sprinklers shall be of one manufacturer throughout building. No mixing of sprinkler brands shall be permitted.

a. Exception: For special sprinklers not available by one manufacturer.

2. Sprinklers shall be UL listed for working water pressures up to 175 PSI.

3. Quick response sprinkler heads shall be installed in new construction accordance with the requirements in NFPA 13.

4. Temperature ratings for sprinkler heads shall be in accordance with NFPA 13.

a. The minimum sprinkler head temperature rating for "Ordinary" sprinkler temperature classification shall be 155°F.

5. Provide corrosion resistance sprinkler heads.

6. Provide spare heads of each temperature rating and type used in a suitable metal cabinet with red enamel finish, cabinet to be located as required by SFIA Fire Marshal requirements (Fire Command Center). Number of spare heads in accordance with NFPA 13. In addition to the spare heads, furnish not less than two special sprinkler head wrenches.

7. Viking 1021 stainless steel sprinkler heads.

B. Basis of design sprinkler heads are specified as a standard. Acceptable equivalent manufacturers for sprinkler heads as follows:

1. Viking.

2. Victaulic.

3. Tyco.

4. Or equal.

2.16 INCOMING FIRE RISER MAIN

A. For incoming fire main below ground, provide stainless steel pipe Schedule 40 ASTM A-312, Type 316L pipe with Schedule 40SLR 90 welded elbow and 150 lb forged stainless steel flanges Type 316L. Provide polyethylene tube encasing for the entire riser main below ground.

PART 3 - EXECUTION

3.01 SPRINKLER SYSTEM DESIGN

A. Building(s) shall be fully protected by a hydraulically calculated automatic wet sprinkler system in accordance with the requirements of NFPA 307, CFC, CBC, NFPA 13 as amended by Chapter 80 of CFC 2022 Edition.

B. Total Combined Inside and Outside Hose Allowances: Hydraulic calculations shall include an allowance for inside and outside hose streams to the sprinkler requirements for hose streams added at the point of connection to the water supply.

C. The arrangements, positions, and connections of pipes, drains, etc., shall be as required by NFPA 13, however, the right is reserved by the SFIA to change the location of any item to accommodate conditions which may arise during the progress of the work without additional compensation for such changes, provided that no additional heads are required and provided that changes are requested prior to installation of work.

1. The following requirement takes precedence over the requirements in NFPA: Sprinkler system control valves shall be located in accessible spaces and shall not be located in above ceiling spaces.

3.02 DRAWINGS AND SITE

A. Drawings:

1. Scaled and figured dimensions are approximate and are given for estimate purposes only. Before proceeding with work, carefully check and verify dimensions, sizes and lengths.

2. So far as possible the work has been indicated on the drawings in such positions as to suit and accommodate the work of the other trades, but the work as indicated is largely diagrammatic and is shown primarily for clarity. Contractor is responsible for the correct placing of their work and the proper location and connection of work in relation to the work of other trades.

3. Where apparatus and equipment have been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. Carefully check the drawings to see that the equipment will fit into the spaces provided.

4. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.

5. Contact Port's Representative before digging and investigate and confirm existing conditions. Secure permit from Port's Representative prior to initiation of underground excavation.

3.03 PREPARATION

A. Sprinkler heads in finished areas shall be installed on a true axis line in both directions with a maximum deviation from the axis line of plus or minus ½". At the completion of the installation, if any heads are found to exceed the above-mentioned tolerance, such heads shall be removed and satisfactorily reinstalled. In areas with ceiling tiles, fire sprinklers shall be installed in center of tiles.

B. Sprinkler head locations shown on architectural reflected ceiling plans show head locations in architecturally sensitive areas required by the Architect. Head locations shown are approximate and for intent of pattern layout only. It is not the intent to show all heads. Number of heads shown may be in excess of minimum code requirements, but in no case shall the Contractor furnish less heads than or spaced greater than required by code. Where heads are not shown, location is per code requirement and left to the discretion of the Contractor. Before starting Shop Drawings, submit drawings showing only the proposed head layout on architectural reflected ceiling plans.

C. Locate pipe and sprinkler heads fully coordinated with grilles, diffusers, reflected ceiling plans, ducts, conduits, light fixtures, curtain tracks and other ceiling elements. Maintain proper code clearances from ceiling obstructions and symmetrical layout.

3.04 TEMPORARY FIRE PROTECTION

A. Provide all temporary valves, piping, fire department connections and other components as directed by the Port's Fire Marshal and Port during all phases of construction.

3.05 GENERAL INSTALLATION

A. Fire safety during construction shall comply with the requirements in the California Building Code (CBC), California Fire Code (CFC), and National Fire Protection Association (NFPA) 241.

B. Wharf's beams and other potential obstructions shall not interfere with the engineered spray patterns of sprinkler heads. The sprinkler contractor shall insure that the type and location of potential obstructions is considered in the design and installation of the system. The sprinkler contractor is responsible for coordinating and resolving conflicts in coverage patterns.

C. System valves and gauges shall be accessible for operation, inspection, tests, and maintenance.

D. No valve and no piece of equipment or trim shall support the weight of any pipe.

E. No cutting, drilling or taping of structural members shall be done without prior written approval of the structural engineer.

F. Powder actuated fastening will not be allowed. Embeds, beam clamps, or drilled fasteners will be required, unless otherwise noted.

G. Install access doors in ceilings of rooms where above ceiling access is required. Comply with the requirements of Section 083100 "Access Doors and Frames".

H. Any modifications to system required by field conditions, physical equipment changes or compliance with code regulations shall be made promptly without any cost to the SFIA.

3.06 PIPING INSTALLATION

A. Carry exposed and concealed horizontal lines of pipe on specified hangers properly spaced and set to allow the pipe to adjust for expansion and contraction.

B. Check piping runs beforehand with other trades. Run piping to maintain proper clearance for maintenance and to clear opening in exposed area. Run piping in strict coordination with mechanical piping, ducts, and equipment, plumbing work, electrical conduit and equipment, structural, and architectural conditions. Where work of other trades prevents installation of the piping as shown on the Drawings, reroute piping at no extra cost. Piping shall be installed within designated finished ceiling height as noted on the architectural drawings.

C. Install pipe with necessary offsets and fittings to conform to the structure. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid obstruction, preserve headroom, maintain required accessibility, keep openings and passages clear, and satisfy the requirements of the governing codes and standards of good practice. The locations of piping and mounting heights of sprinkler heads and equipment shall be coordinated with the architectural plans and room elevations.

D. Install exposed piping parallel to or at right angles with building walls and tight to walls or ceilings wherever possible, except where otherwise shown on the Drawings. Piping shall be arranged to form a symmetrical pattern. Horizontal piping shall be supported at intervals not to exceed spacing permitted by NFPA 13 & 307. Vertical risers shall be supported at the base and at each floor level with clamps and hangers.

E. Provide sleeves wherever pipes are run through walls, concrete, and slabs, to allow large enough openings for the passage of the pipe. Set sleeves in forms before concrete is poured. Sleeve size shall be not less than a nominal diameter 2” larger than the nominal diameter of piping 3½" and smaller, and a nominal diameter 4" larger than the nominal diameter of piping 4" and larger or as approved by NFPA. The space between each pipe and sleeve shall be completely closed by packing with code approved mineral fiber materials with a suitable binder or other approved packing material. Piping through rated walls and floors shall be sealed with UL fire rated fireproof material, in accordance with code requirements. Pipes through underground exterior walls shall be sealed watertight. Provide link seal protection at sleeves in underground exterior walls and as noted on the drawings.

F. Clearance from structural members not penetrated or used, collectively or independently, to support the piping shall be at least 2”.

G. Support pipe from the building structure so that there is no apparent deflection in pipe runs. Fit piping with steel sway braces and anchors to prevent vibration and/or horizontal displacement under load when required. Do not support pipe from or brace to ducts, other pipes, conduit, or any materials shown on the Drawings. Piping or equipment shall be immobile and shall not be supported or hung by wire, rope, plumber's tape or blocking of any kind.

H. Screw joints shall be American Standard pipe thread, graphite and oil compound, or an approved pipe thread sealing tape shall be applied to the male threads only.

I. Arrange riser and piping to maintain a minimum clear width at stairways of 44” and with minimum headroom of 7’-6” for piping.

J. Do not run piping through stairways, transformer vaults, MDF/Server equipment rooms, electrical rooms and other electrical or electronic equipment spaces and enclosures unless piping is serving these spaces. Coordinate piping layout to prevent installation directly over

electrical equipment. If pipe routing is unavoidable, provide galvanized sheet metal drain pans under piping to prevent leaking pipe drips from damaging equipment while maintaining sprinkler coverage.

K. Piping shall not be installed within the vertical space above electrical switchboards, panelboards, distribution boards, or battery charging panels (see Section 384-4, National Electrical Code).

L. Use full pipe lengths; random lengths joined by couplings will be used as needed.

M. Provide for expansion and contraction of pipes and for seismic movement.

N. Provide reducing fittings for changes in pipe size; provide fittings for changes in pipe direction. Reductions in pipe sizes shall be made using one-piece reducing fitting. Bushings are not acceptable, except when standard fittings of proper size are not manufactured. Riser piping shall be installed plumb with offset fittings used where alignment adjustment is necessary.

O. Provide unions for pipe sizes smaller than 2" and flanged or grooved fittings for sizes 2" and larger.

P. Provide dielectric fittings where dissimilar piping materials are joined.

Q. Piping arrangement shall avoid beams, columns, ducts, lighting fixtures, doors, windows, and similar obstructions and openings.

3.07 INSTALLATION OF UNDERGROUND PIPE AND PIPE FITTINGS

A. Ductile Iron Pipe: Install in accordance with AWWA C600 "Standard for Installation of Ductile Iron Water Mains and Their Appurtenances" and in accordance with manufacturer's instructions.

B. Depth of Cover: Provide minimum depth of cover over underground piping in accordance with NFPA 24, "Recommended Depth of Cover Above Top of Underground Yard Mains." Underground piping shall have a minimum of 36". Cover shall be measured from finished grade to top of pipe.

C. Piping shall be laid straight and level. Deflection shall not be allowed in the couplings. Changes in elevations or direction shall be accomplished with fittings approved for the application.

D. Anchorages: Tees, wyes, crosses, plugs, caps, bends, valves, and hydrant branches shall be restrained against movement. Pipe clamps and tie rods, thrust blocks, locked mechanical or push on joints, mechanical joints utilizing set screw retainer glands, or other approved methods or devices shall be used. The type of pipe, soil conditions, and available space determine the method. After installation, apply full coat of asphalt or other acceptable corrosion retarding material to surfaces of ferrous anchorages. For thrust blocks: Thrust blocks shall be calculated as required by NFPA 24 2022 Edition, Section A10.6.1. Calculations shall be shown on the plans. Provide access to thrust blocks and corrosion-coated parts prior to backfill for inspection.

E. When the system riser is close to building foundations, underground fittings such as an "In-Building Riser" of proper length shall be used to avoid pipe joints being located in or under the foundation. When the connection passes through a foundation wall below grade, 1" to 3" clearance shall be provided around the pipe, and the clear space shall be made water-tight using an approved mechanical seal, or similar flexible waterproofing material. No joints in the piping system shall be installed under the building.

F. Floor cores and sleeves in floors at grade, or in exterior walls below grade, shall be made water-tight using an approved mechanical seal, installed flush with the top of the sleeve at floors; flush with the outer surface at walls.

G. Underground piping shall terminate in a welded or cast flanged fitting 6” minimum above finished floor.

H. Buried piping, castings, fittings, valves and couplings below ground shall be encased in 8 mil polyethylene tube encasement.

3.08 INSTALLATION OF POLYETHYLENE ENCASEMENT

A. Provide polyethylene encasement for buried piping. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely air and watertight enclosure. Overlaps shall be secured by the use of polyethylene adhesive tape, plastic string or other non-degradable material and be capable of holding the encasement in place until backfilling operations are completed. Pipe and fittings shall be wrapped with polyethylene prior to pouring concrete thrust blocks.

B. Install in accordance with manufacturer’s installation instructions and reference standards. Install polyethylene encasement using Method A - For use with Polyethylene Tubes.

C. Repair cuts, tears, punctures, or damage to polyethylene with polyethylene adhesive tape or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.

D. Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least three feet (3'). Secure the end with circumferential turns of tape. Service lines and other attached lines of dissimilar metals shall be wrapped with polyethylene or a suitable dielectric tape for a minimum clear distance of three feet (3') away from the ductile-iron pipe.

E. Backfilling for Polyethylene-Wrapped Pipe:

1. Use the same backfill material as specified for pipe without polyethylene wrap, exercising care to prevent damage to the polyethylene wrapping when placing backfill material.

2. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, or other material that could damage the polyethylene. Backfill shall be as specified for the pipe without polyethylene encasement.

3.09 GROOVED JOINT INSTALLATION

A. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. Grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by Victaulic, or equal. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace improperly installed products.

3.10 INSTALLATION OF VALVES

A. Install valves for proper operation of piping and equipment, including valves in branch lines to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Install valves with stems pointed up in vertical position where possible, or in horizontal plane if necessary, but in no case with stems pointed downward from horizontal plane unless absolutely unavoidable.

C. Install swing check valves in horizontal position, unless otherwise shown on the drawings, with hinge pin horizontally perpendicular to center of pipe. Install for proper direction of flow. Installations on vertical piping must be with up flow only. Vertical installation allowed only when acceptable to valve manufacturer and when the valve is listed to be installed in that orientation.

D. Ball and butterfly valves shall not be used on incoming water service. Butterfly valves only allowed for use as a floor or zone control valve.

E. Valves installed higher than 7'-0 shall be equipped with chain operators, or equivalent.

F. Sprinkler system control valves must be located in accessible locations. Sprinkler system control valves are not permitted in above ceiling spaces.

G. Coordinate the location, signage, keying, and access of fire sprinkler shut off and zone valves with the SFIA Fire Marshal's office. Access and signage shall be obvious. Visibility shall not be blocked by equipment.

3.11 INSTALLATION OF PRESSURE GAUGES

A. Provide a pressure gage on the system side of control valves, at the top of each sprinkler or standpipe riser, and where indicated on the drawings.

3.12 INSTALLATION OF SUPERVISORY SWITCHES AND WATER FLOW SWITCHES

A. Supervisory Switches: For each indicating valve, sprinkler system riser, sprinkler zone, standpipe system riser, main service entrance, control valve, and where indicated on the drawings, provide a supervisory switch that is connected to the fire alarm system. Standpipe hose valves and test and drain valves shall not be provided with supervisory switches.

1. Coordinate installation with Division 28 – Fire Alarm and Detection System.

B. Water Flow Switches: A water flow switch shall be provided for each sprinkler zone, each standpipe riser and where indicated on drawings. Install water flow switch in easily accessible locations. Each water flow switch shall be annunciated at the main fire alarm control unit and required annunciators.

1. Coordinate installation with Division 28 – Fire Alarm and Detection System.

3.13 FLUSHING, TESTING AND ADJUSTING

A. Test automatic sprinkler system in accordance with NFPA 13. Test standpipe system in accordance with NFPA 14. Test private service mains in accordance with NFPA 24.

B. Perform tests in the presence of authorities having jurisdiction. Provide labor, materials, equipment and connections and submit results for review. Repair or replace defective work and

pay for restoring or replacing damaged work, due to tests, as directed. Equipment required for testing, including fittings for additional operating shall be provided by the Contractor.

C. System Piping Flushing: Underground mains and lead-in connections to system risers shall be completely flushed before connection is made to sprinkler piping. The flushing operation shall be continued for a sufficient time to ensure thorough cleaning. The minimum flow rate shall be not less than the hydraulically calculated water demand rate of the system including hose requirements, or a flow necessary to provide a velocity of not less than 10 feet per second (3 meters per second), or the maximum flow rate available to the system under fire conditions. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system to remove foreign substances, under pressure as specified in NFPA 13 and NFPA 24. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers. While conducting the flushing operation, the Contractor shall exercise care that the water does not create any damage. The Contractor shall be responsible for damage caused by this operation.

1. Flow required to produce a velocity of ten (10) feet per second:

   a. 4" – 390 gpm.

   b. 6" – 880 gpm.

D. Hydrostatic Testing: After flushing system, test fire sprinkler piping and standpipe piping hydrostatically as required by NFPA 13, 14, 15, and 24, but not less than for period of two (2) hours at two-hundred (200) PSIG, or at fifty (50) PSI above maximum static pressure if it is greater than one hundred-fifty (150) PSI. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested. Hydrostatic test preparation:

1. Underground, rooftop, and other piping directly exposed to the exterior environment during testing shall be filled with water for twenty-four (24) hours preceding hydrostatic testing.

2. Interior piping shall be filled with water for two (2) hours preceding hydrostatic testing.

3. Piping shall be purged of all air and other gases prior to hydrostatic testing. Pressure increase during testing shall constitute test failure.

4. Underground piping shall be center loaded and fittings, joints, strapping, and thrust blocking shall be exposed for hydrostatic pressure testing and inspection.

5. Above grade and interior piping, fittings, and supports shall be exposed for inspections and hydrostatic testing. Testing shall include finished drops and sprinklers. Incremental testing may be approved, at Contractor's request and expense, by the SFIA, for the purpose of expediting project progress-this shall not, however, take the place of a final test of the entire system.

6. Threaded fittings and grooved couplings, as well as a minimum of 2" of the pipe connected to such fittings and couplings, shall be unpainted at the time of the test.

E. Underground Piping Tests: Underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be within the limits prescribed by NFPA 24 and shall be recorded on the test certificate. Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline with water 24 hours prior to testing, and apply test pressure to stabilize system.

F. Fire department connections and piping shall be included in the hydrostatic testing and shall also be back flushed.

G. Repair or replace piping system to eliminate leakage in accordance with NFPA standards for "little or no leakage" and retest as specified to demonstrate compliance.

H. Water remaining in normally dry piping shall be evacuated at completion of testing.

I. The inspection, hydrostatic test and flushing of the sprinkler system shall be witnessed by the authority having jurisdiction, and SFIA’s Representative. No underground piping shall be covered with earth or hidden from view until the fire department’s representative has been notified and given no less than forty-eight (48) hours in which to inspect such installations.

J. Provisions shall be made for the proper disposal of water used for flushing or testing.

K. Provide complete adjustment of sensitivity of water flow and supervisory (tamper) switches. Coordinate with Division 28 Contractor.

L. After the inspection has been approved, the Contractor shall certify in writing the time, date, name and title of the person reviewing the test. This shall also include the description and what portion of the system has been approved.

M. After final installation, all backflow prevention devices shall be field tested by a certified technician certified with the San Mateo County of Health. The technician shall be hired by the Contractor. A copy of the test results submitted to the SFIA Water Service Inspector and Plumbing Inspector for approval. A San Mateo County tag shall be affixed to the backflow prevention device after approval is given. The backflow prevention assembly shall be forward flow tested to ensure proper operation. The minimum flow rate shall be the system demand, including hose stream demand where applicable.

N. A complete record shall be maintained of testing that has been approved, and shall be made available at the job site.

O. Upon completion of the work, records and certifications approving testing requirements shall be submitted to the SFIA’s Representative and before final payment is made.

P. Defective work or material shall be replaced or repaired, as necessary, and the inspection and test repeated, at Contractor's cost. Repairs shall be made with new materials.

Q. No part of work shall be covered until after it is inspected, tested, and approved.

3.14 INSPECTION

A. After completion of the fire protection installation and at the start of the guarantee period, execute the National Automatic Sprinkler and Fire Control Association, Inc. standard form of Inspection Agreement, at no increase in Contract Sum, calling for one (1) additional annual inspection for the sprinkler system during the guarantee year, plus the following maintenance to be performed during the course of the fourth inspection:

1. Operating of control valves.

2. Lubrication of operating stems of control valves.

3. Operating of electrical alarms.

4. Cleaning of alarm valves.

5. Lubrication of Fire Department hose connection inlets.

6. Main drain test.

B. Fill out Inspection Agreement in triplicate after each inspection and send copies to the SFIA.

3.15 PROTECTION, CARE AND CLEANING

A. Provide adequate means for, and fully protect, finished parts of the materials and equipment against physical damage from whatever cause during the progress of this work and until final completion.

B. During construction, properly cap lines and equipment nozzles so as to prevent entrance of sand, dirt, and the like. Protect equipment against moisture, plaster, cement, paint or other work of other trades by covering it with polyethylene sheets.

C. Thoroughly clean exterior and interior of piping, equipment, and materials before systems are put into operation. Systems of any nature shall be thoroughly cleaned and flushed of pipe contaminates such as cuttings, filings, lubricant, rust, scale, grease, solder, flux, welding residue, debris, and other foreign substances. Any piece of equipment or part of any system which malfunctions or is damaged due to failure or neglect on the part of this Division to observe this paragraph shall be repaired or replaced to the satisfaction of the SFIA by and at the total expense of this Contract.

D. After installation have been completed, clean systems.

1. Piping and Equipment: Clean exterior thoroughly to remove rust, plaster, cement, and dirt before insulation is applied.

2. Items with Factory Finish: Remove grease and oil, and leave surfaces clean and polished.

3. Chrome or Nickel Plated Work: Thoroughly polish.

4. Factory Finished Items: Remove grease and oil and leave surfaces clean and polished.

5. Code stamps and nameplates shall be protected from damage and must be clean and legible before final inspection.

3.16 LABELING AND IDENTIFICATION

A. Provide pipe, valve, and equipment identification, and signage in accordance with referenced standards, codes and specifications.

B. Provide hydraulic design information signage as required by NFPA 13.

C. Provide next to sprinkler main risers a framed, printed sheet protected by transparent plastic, safety glass, or plexiglass cover with brief instructions regarding necessary aspects of sprinkler controls and emergency procedure.

3.17 INSTALLATION OF IDENTIFICATION SIGNS

A. Provide identification signs in accordance with referenced standards, to include, but not be

limited to: the fire department connection(s), control valves, each standpipe isolation valve, each main or auxiliary drain valve, test connection valves, each inspector's test valve, and, for hydraulically-designed systems, a hydraulic system calculation nameplate. In addition, provide signs identifying access panels concealing sprinkler control or test valves. Provide a sign on or directly below the local water flow alarm.

B. Sprinkler and standpipe control valves shall be provided with identification signs at each valve to indicate its function and what it controls. Also, sprinkler control valves, including pressure regulating control valves (PRV's), shall be provided with a permanent label/tag which provide the static pressure and residual pressure at a particular flow that is available at the valve outlet.

C. Note: Field adjustable pressure regulation valves (PRV's) for sprinkler systems and standpipes, including fire pump suction and discharge PRV's, must have a permanent tag which indicate the pressure setting, required to obtain thehydraulically calculated outlet pressure. All pressures shall be verified during field testing per SFFD AB4.13..

D. A permanently installed, metal calculation plate shall be attached at the sprinkler riser indicating sprinkler specifications as required by NFPA 13. Use of plastic tape shall not be permitted on the calculation plate.

E. Approved identification signs shall be provided for outside alarm devices such as alarm bells, and the like.

3.18 ACCESSIBILITY

A. The installation of valves, gages, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement shall be conveniently and accessibly located with reference to the finished building.

3.19 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause any work to be covered up or enclosed until inspected, tested and approved.

3.20 EMERGENCY REPAIRS

A. The Port reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the guarantee bond or relieving the Contractor of their responsibility during the bonding period.

3.21 CLEANING UP AND REMOVAL OF SCRAP

A. For work under Mechanical Sections, trash and scrap shall be cleaned up and removed from the site as the work progresses.

3.22 PRELIMINARY OPERATIONS

A. The SFIA reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

3.23 EXCAVATION AND TRENCHING: (Required for this section)

A. Trenches for underground piping shall have uniform grades same as for pipe. Pipe shall be embedded in six inches (6") minimum layer of clean sand all around.

B. Loose earth shall be tamped solid around sides and on top of sand-covered pipe and remainder thoroughly compacted to prevent settlement of the surface. After completion of backfill, the grade shall be finished to match the existing, or as directed. Paving and walkways shall be finished to match the existing.

C. Provide and maintain dewatering pumps as required. After piping has been installed, it shall be inspected and approved by the authority having jurisdiction before backfilling. Backfill shall not be placed on or around piping for twenty-four (24) hours after pipe joints have been made and before lines are properly tested and approved.

D. Provide barricades, signs, lanterns, shoring, sheeting and pumping as part of Work in this Division to insure safe conditions. Provide shoring and cross bracing of sufficient strength to properly support the walls of excavations at depth of 4'-0" or more to protect personnel, and as required by OSHA.

E. Minimum bury for piping exterior to the building shall be 36" minimum cover from top of pipe to finished grade except as otherwise shown, or as determined by invert elevations. Contractor shall verify piping elevations, and invert elevations before starting work.

F. Excavation and pipe installation on public property shall be fully coordinated for timing and procedures with the authorities having jurisdiction. Work shall conform to local Public Work rules and regulations. Paved areas and concrete sidewalks damaged during this work shall be repaired to match existing when new to the satisfaction of the governing authorities.

G. Dispose of surplus excavation material and seepage water as directed by General Contractor and in accordance with local codes and applicable laws.

H. Water piping shall not be run in the same trench with sewer or drainage piping unless separated as required by the plumbing code.

3.24 BACKFILL

A. Trenches: Do not place backfill in trenches until pipe installation has been reviewed and accepted by the SFIA's Representative.

B. Within twenty-four (24) hours or as soon as pipe has been laid and inspected, place backfill in layers to the elevation at which excavation was begun, or to a height of 6" from rocks or lumps greater than 4" in any dimensions. Place backfill in 6" layers and bring up evenly and tamp continually on both sides of pipe. Use excavated materials or other approved materials as directed. Tamp by hand or with pneumatic tampers. Machine tamping and compaction by flooding or puddling will not be accepted.

C. Compaction: Relative compaction of backfilling for pipe trenches and concrete structures shall be not less than 90 percent in accordance with Test Method No. Calif. 216 and ASTM D1557-58T. Fills below structures and the upper 18" of sub-grade beneath areas to be paved shall be compacted to 95%.

D. Settling: Backfill which subsides or settles below finish grades or adjacent ground during warranty period shall be removed to top of pipe and replaced with compacted fill as specified.

3.25 GUARANTEE

A. At completion, furnish the SFIA's Representative a written guarantee, in triplicate, that work has been performed in accordance with Drawings and Specifications and to replace or repair, to the satisfaction of the SFIA's Representative any portion of the work that fails within the guarantee

period after final acceptance provided such failure is due to defects in materials or workmanship. Also agree to replace or repair, with like workmanship and materials, any part of the building or equipment installed by other trades but damaged by them in installing their work.

B. Guarantee in writing fire protection work and materials for a period of twelve (12) months following date of certificate of final acceptance.

C. During the guarantee period, make one (1) additional annual inspection after final acceptance to check the performance of systems and correct any guaranteed items. Inspections to be made in the presence of the SFIA's Representative.

D. Apparatus shall be built and installed so as to deliver its full rated capacity at the efficiency for which it was designed.

E. Fire protection and electrical apparatus shall operate at full capacity without objectionable noise or vibration.

F. The fire protection systems shall provide the performance required at standard operating conditions.

G. Manufacturers whose equipment has a longer guarantee period shall provide a written guarantee.

H. Submit guarantees/warranties in accordance with 017836 "Warranties".

3.26 TRAINING

A. Submit a written test schedule to the SFIA's Representative for approval a minimum of three (3) weeks prior to proposed training dates.

B. Provide three (3) sessions of two (2) hours each of instruction to the SFIA including SFFD emergency responders with regard to proper use and operation of the system. Submit a written course outline and a sample of manuals to be used two (2) weeks prior to the scheduling of the training. Training shall include both classroom and "hands-on" sessions and shall occur after final inspection and testing. Location and timing of the training session is to be arranged with the SFIA's Representative.

C. Two weeks prior to scheduled training dates, furnish the SFIA's Representative with six (6) bound copies of complete instructions, including catalog cuts, diagrams, drawings, and other descriptive data covering the proper testing, operation, and maintenance of each type of system installed, and the necessary information for ordering replacement parts. In addition, post one (1) copy of complete instructions at the Fire Command center (FCC) and main valve room.

D. Session shall include detailed training and instructions covering the necessary and recommended testing, operating, and maintenance procedures for each type of system. Session shall include training and instructions covering the emergency operation procedures for each type of system.

E. Session shall include training and instructions covering the emergency operation procedures for each type of system.

3.27 OPERATION AND MAINTENANCE MANUALS

A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to the SFIA not less than 30 days prior to completion of a phase or final inspection.

END OF SECTION

SECTION 22 11 00

FACILITY WATER SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this section.

1.02 SUMMARY

A. This section describes the requirements for domestic water, recycled water and non-potable water piping systems. Section includes but is not limited to:

1. All piping and fitting types.

2. Pipe corrosion protection.

3. All valves types.

4. Pressure gauges.

5. Flexible connectors.

6. Hose bibbs.

7. Water samples: Specified in Part 3 "Pipe Disinfection and Cleaning" Article.

1.03 APPLICABLE CODES

A. California Building Codes with Port of San Francisco Amendments, 2022 edition

B. California Plumbing Codes with Port of San Francisco Amendments, 2022 edition

C. San Francisco Administrative Bulletins, latest edition.

1.04 REFERENCE STANDARDS

A. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work of this section where cited by abbreviations noted below.

1. American National Standard Institute (ANSI).

2. American Society of Mechanical Engineers (ASME).

3. American Society of Plumbing Engineers (ASPE).

4. American Society of Sanitary Engineers (ASSE).

5. American Standards for Testing and Materials (ASTM).

6. American Water Works Association (AWWA).

7. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

B. Comply with the latest edition of all applicable standards. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

1. ANSI/ASME B16.15-85(R 1994): Cast Bronze Threaded Fittings.

2. ANSI/ASME B16.18-01: Cast Copper Alloy Solder-Joint Pressure Fittings.

3. ANSI/ASME B16.22-01: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

4. ANSI/AWWA C105/A21.5-10: Standard for Polyethylene Encasement for Ductile Iron Pipe Systems.

5. ASSE 1001-2017: Atmospheric Type Vacuum Breakers.

6. ASSE 1003-2009: Water Pressure Reducing Valves for Domestic Water Distribution Systems.

7. ASSE 1011-2017: Hose Connection Vacuum Breakers.

8. ASSE 1019-2011(R2016): Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.

9. ASSE 1020-2004: Pressure Vacuum Breaker Assembly.

10. ASSE 1079-2012: Dielectric Pipe Unions.

11. ASTM A53-02: Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless.

12. ASTM A183-83: Carbon Steel Track Bolts and Nuts.

13. ASTM A536-84: Ductile Iron Castings.

14. ASTM A733-03: Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.

15. ASTM B32-03: Solder Metal.

16. ASTM B88-03: Seamless Copper Water Tube.

17. AWS: A5.8-04: Specification for Filler Metals for Brazing and Braze Welding.

18. MSS SP-25-98: Standard Marking System for Valves, Fittings, Flanges and Unions.

19. MSS SP-72-99: Ball Valves with Flanged or Butt Welding for General Purpose.

20. MSS SP-110-96: Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends.

C. Minimum requirements: The requirements of these Specifications are the minimum that will be allowed, unless such requirements are exceeded by applicable codes or

regulations, in which the local regulatory code or regulation requirement of this competition shall govern.

D. Nothing in the Specifications or Drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Port’s Representative.

1.05 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components and Annex G.

C. Soldering: Soldering of copper tubing shall be done in accordance with the Copper Development Association Copper Tube Handbook Instruction on Joining and Forming Copper Tube, Soldered Joints. Permits for on-site soldering shall be obtained from the Fire Marshal.

1.06 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Port’s Representative.

C. Protection of Materials:

1. Protect materials, equipment and apparatus provided under this Division from damage, water, dust, or similar impairment, both in storage and installation until Notice of Completion has been filed. Materials, equipment or apparatus damaged because of improper storage or protection will be rejected and must be removed from site.

2. Cap openings in pipes with manufactured caps or fittings. Do not use taped caps.

3. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.

D. Valves shall be prepared for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads.

3. Set ball and plug valves open to minimize exposure of functional surfaces

4. Block check valves in either closed or open position.

E. Valves shall be prepared for storage as follows:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature.

1.07 SUBMITTALS

A. Submit product data and brochures for, but not limited to the following:

1. All piping and fitting types.

2. Pipe corrosion protection.

3. All valves types.

4. Pressure gauges.

5. Flexible connectors.

6. Hose bibbs.

7. Water samples: Specified in Part 3 "Pipe Disinfection and Cleaning" Article.

B. Coordination Drawings: Plans and details, drawn to scale (1/8 inch equals 1 foot scale), on which piping is shown and coordinated with other installations, using input from installers of the items involved.

C. Site Survey: Plans, drawn to scale (1 inch equals 20 feet scale), on which water piping and equipment are shown and coordinated with other services and utilities.

D. Qualification Data: For qualified registered professional Structural Engineer.

E. Brazing certificates.

F. Field quality-control reports.

PART 2 - PRODUCTS

2.01 LEAD FREE PRODUCTS

A. Materials used for potable water use shall be "Lead Free" compliant and be certified to NSF/ANSI 61 Annex G, NSF/ANSI 372 "Drinking Water System Components – Lead Content." Note: Although NSF/ANSI 61 Annex G was retired from NSF/ANSI 61 as of October 2013, products certified to NSF/ANSI 61 Annex G are also compliant with NSF/ANSI 372 and conforms the U.S. Safe Drinking Water Act (SWDA).

B. Specified model numbers may not be up to date to reflect "Lead Free" model number. Provide equivalent "Lead Free" model.

2.02 CHLORAMINE RESISTANT PRODUCTS

A. All materials used in plumbing products, such as seals and gaskets that come in contact with water, shall be of a chloramine resistant material. These materials shall be a high quality rubber (Synthetic Polymer) or a specially formulated chloramine resistant EPDM for all wetted components. Materials shall be NSF/ANSI 61 certified for potable water use. Contractor shall be responsible to furnish chloramine resistant material.

2.03 DOMESTIC WATER PIPING SYSTEMS

A. Above Ground/Below Pier:

a. Type 316 stainless steel Schedule 40 ASTM 312 Standards seamless pipe with threaded or press fittings. Pipe and fittings shall be NSF 61 Certified and bear the NSF certification mark.

B. Below Ground:

1. Pipe Size 3" and Smaller: Copper tube; Type "K", hard-drawn temper; wrought-copper fittings, brazed-joints, long radius elbows. Pipe shall be NSF 61 Certified and bear the NSF Certification mark. Submittal to include documentation that pipe is NSF 61 certified.

a. Brazing Filler Metals: Brazing alloys, AWS A5.8 classification BCuP (Brazing Copper Phosphorus), cadium free brazing filler. The use of flux is prohibited.

2.04 CORROSION PROTECTION FOR PIPE AND FITTINGS

A. Buried Piping: All buried copper piping, castings, fittings, valves and couplings below ground shall be cleaned, primed then fully protected by encasing in 8 mil polyethylene tube encasement. Polyethylene wrap shall be manufactured of 0.008 inches (8 mils) minimum, group 2, linear low density, flat tube, polyethylene manufactured of virgin polyethylene material that meets or exceeds the specifications of the latest revision of AWWA C105 and ANSI A21.5, ASTM D4976 and NT4112. All wrappings shall be installed on site only.

1. Minimum properties as follows:

a. Tensile Strength: 3,600 PSI minimum – ASTM D882.

b. Elongation: 800% minimum – ASTM 882.

c. Dielectric Strength: 800 V/mil, minimum – ASTM D149.

d. Impact Resistance: 600g, minimum – ASTM D1709-B.

e. Propagation Tear Resistance: 2550 gf, minimum – ASTM D1922.

f. Density: 0.910 to 0.935 g/cm^3.

2. Color: The polyethylene film shall be blue for domestic water lines.

3. Markings: The polyethylene film supplied shall be clearly marked, at a minimum of every two feet (2') along its length, containing the following verbiage:

a. Manufacturer's Name and Trademark.

b. Year of manufacture.

c. Minimum film thickness and material type.

d. Specification conformance: "ANSI/AWWA C105/A21.5-05.

e. Applicable pipe sizes.

f. Text: "Warning Corrosion Protection - Repair Any Damage". Purple Polyethylene will contain the additional text "Caution Recycled Water Line".

4. Acceptable Manufacturers:

a. Christy’s.

b. Northtown Pipe Protection Products.

c. Trumbull Manufacturing.

d. U.S. Pipe.

e. Or Equal.

B. Un-insulated copper pipe through ferrous sleeves or in contact with cement or concrete: Wrap pipe with two (2) layers of heavy plastic protective tape. Finish wrapping flush with sleeve ends. Prime pipe and machine wrap pipe using 50% overlap wrap, with polyvinyl chloride tape. Hand wrap fittings using 100% overlap wrap extending 6" beyond fitting onto wrapped pipe. Comply with tape manufacturer's installation instructions. Wrap pipe with "Scotchrap 51” corrosion protection tape (20 mils thick) and pipe primer, 3M Co., Minneapolis, MN; "Polyken 900" Kendall Co. Polyken Div., Boston MA; or equal.

C. Resiliently isolate any copper piping with pipe insulators to prevent steel to copper contact.

2.05 VALVES

A. General:

1. Provide all valves of first quality of approved manufacturer, have proper clearances, and be tight at the specified test pressure. Mark on each valve the maker's name or brand, the figure or list number, and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or provided with other means of easy identification.

2. All valves must be of the product of one manufacturer, except for special application. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality and appearance.

3. Sizes: Same size as upstream pipe, unless otherwise indicated.

4. End Connection: Valves 2” and under shall be sweat or threaded.

5. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality and appearance.

6. Lead Content: Valves used for domestic water service shall be “Lead Free” with less than 0.25% lead weight content by weight on wetted surfaces. Valves shall be California AB 1953 compliant and be certified to NSF/ANSI Standard 61, Annex G and/or NSF/ANSI 372. Specified model numbers may not be up to date to reflect “Lead Free” model number. Provide equivalent “Lead Free” model.

B. Shut-Off Valves 2” and Smaller:

1. Ball Valves: MSS SP-110; rated for 150 psi saturated steam pressure, 600 psi WOG pressure; lead free, full port, two or three piece bronze body construction, chrome plated solid bronze vented ball, blowout proof stem, reinforced “Teflon” seat and seals, separate adjustable packing gland and nut, and vinyl covered steel handle. Provide locking type handle on all valves. NSF-61 and NSF/ANSI 372 compliant.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Nibco T/S-595-Y-LF.

b. Red & White 5044AB/5049AB.

c. Kitz.

2.06 VALVE BOXES & VAULTS

A. For service shut-off valves on domestic water and for pressure regulator assemblies, shall be Brooks Products, Christy Concrete Products Inc., or Fraser Cement Products Co., concrete type with vandal proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit easy removal of valve assembly. Vaults shall be sectional type.

2.07 PRESSURE GAUGES

A. Drawn steel or brass case, glass lens, 4½" dial, 1% accuracy, ANSI B40.1 Grade 2A, phosphor bronze, bourdon tube, brass bottom connection.

1. Scale: White coated aluminum with permanently etched markings, black graduations and numerals, 270° arc scale.

2. Range: Dial range approximately twice the working pressure.

B. Provide pressure gauge cocks between pressure gauges and gauge tees on piping system. Construct gauge cock of brass with ¼" female NPT on each end, and "T" handle brass plug.

C. Siphon: ¼" straight coil constructed of brass tubing with ¼" male NPT on each end.

D. Snubber: ¼" brass bushing with corrosion resistant porous stainless steel filter disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating. Manufacturer shall be same as for gauges.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft.

2. Marsh.

3. Trerice.

4. US Gauge.

5. Weksler.

6. Weiss.

2.08 FLEXIBLE CONNECTORS

A. All equipment, either rigidly mounted or mounted on vibration isolators, shall be attached to the piping system using flexible connectors designed for seismic movement. Flexible

connectors shall be capable of movement in the ±X, ±Y, and ±Z planes and must completely isolate the equipment from the piping.

B. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61 standards.

C. Flexible connectors shall be flexible corrugated hose and braid, stainless steel, 850ºF rated, 125 psi minimum, 150 lb flange for pipe sizes 2½" and larger, and threaded ends for 2" and smaller.

D. Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.

2. Hyspan.

3. Metraflex Company.

4. U.S. Hose Corporation.

5. Or equal.

2.09 HOSE BIBBS

A. Acceptable Manufacturers: Basis of design models are specified as a standard. Acceptable equivalent manufacturers as follows:

1. Acorn Manufacturing.

2. Jay R. Smith.

3. MAPA Products.

4. Prier.

5. Woodford.

B. HB-1 (Hose Bibb exposed piping installations): Designed to be mounted directly to a wall or column with a 3/4" top mount inlet and with ¾ inch male hose threaded outlet, anti-siphon vacuum breaker, EPDM packing, adjustable brass nut with top stem guard packing nut, standard "O" size washer valve seat, chrome finish, ASSE Standard 1052 approved and IAPMO listed: Furnished with a loose tee key.. Woodford Model Y24 is specified.

PART 3 - EXECUTION

3.01 PIPE AND FITTING INSTALLATION

A. Install copper tubing according to CDA's "Copper Tube Handbook."

B. Install HDPE sleeve and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

C. Install water piping level without pitch and plumb.

D. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished in other sections.

E. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

F. All pipe runs shall be laid out to avoid interference with other work.

G. Install union and shut-off valve on pressure piping at connections to equipment.

3.02 JOINT CONSTRUCTION

A. Joints: Ream pipe ends to remove burrs, inspect each length of pipe carefully and remove all obstructions prior to fabrication.

B. Copper Tubing: Cut square; remove burrs and clean pipe and inside of female fitting to a bright finish with steel wool, wire brush, sandpaper or emery cloth. Apply solder flux with brush to tubing. Remove internal parts of solder-end valves prior to soldering. Provide dielectric unions at points of connection of all copper tubing and any ferrous piping and equipment.

C. Soldered Joints: Use ASTM B813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B828 procedure, unless otherwise indicated.

3.03 EXAMINATION OF VALVES

A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.

B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.

C. Threads on valve and mating pipe shall be examined for form and cleanliness.

D. Do not attempt to repair defective valves; replace with new valves.

3.04 VALVE APPLICATIONS

A. Specifications indicate valve types to be used. The following requirements apply:

1. Shutoff Duty: Use ball valves for piping 2" and smaller.

3.05 INSTALLATION OF VALVES

A. 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.

B. Install calibrated balancing valves in each hot-water circulation return branch. Set calibrated balancing valves partly open to restrict but not stop flow.

C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

D. Valves shall be installed in a position to allow full stem movement.

E. Valves shall be installed in horizontal piping with stems pointed up in vertical position with stem at or above center of pipe. In no case shall stems be pointed downward from horizontal plane unless absolutely unavoidable.

F. Where shut-off valves are installed in the branch line leading to emergency safety equipment (emergency showers and eyewashes), the valves shall be indicating type (OS&Y or ball valve with lever handle), labeled for identification, and locked in the open position.

G. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

H. Rigidly support valves and other equipment to prevent strain on tube or joints.

3.06 INSTALLATION OF HOSE BIBBS

A. Provide hose bibbs as follows:

1. Outdoor Areas: Hose bibbs shall be placed in close proximity of exterior wall. All locations shall be approved by the architect.

B. Where a hose bibb is located in an area accessible to the public such as public accessible outdoor locations, install lock out devices on hose bibb outlet and hose bibb handle to prevent unauthorized water access.

C. Remove wheel handles on all hose bibbs and hand over handles and loose tee keys to the Port. Handles and loose tee keys shall be provided for each hose bibb.

3.07 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices shall be Type 316 stainless steel. Install the following:

1. Vertical Piping: MSS Type 8 riser clamp or Type 42 riser clamp.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers or MSS Type 5 J-Hanger.

b. Type 316 stainless steel U-Hanger, B-Line Fig.120.

c. MSS Type 49, spring cushion rolls, if indicated.

3. Pipes under piers: Attached to pier wood beams at least 4' above the bottom of the wood joist of the beam, use type 316 stainless wood screws.

B. Hanger rod sizing per California Plumbing Code

C. Horizontal Piping: Support horizontal piping per California Plumbing Code.

1. Copper Piping (1½" and smaller): 6 feet maximum.

2. Copper Piping (2" and larger): 10 feet maximum.

D. Vertical Piping: Support vertical piping and tubing per California Plumbing Code.

1. Copper Piping: Provide pipe support at base and each floor, not to exceed 10 feet.

E. Hangers and supports shall be adequate to maintain alignment and prevent sagging. Support horizontal piping within 12-inches of each fitting and coupling. Support shall be provided at each horizontal branch connection. Hangers shall not be placed on joints. Make adequate provision to prevent shear or twisting of the pipe or joint.

F. Every branch of piping over three feet (3') long shall have a separate hanger. Support at each horizontal branch connection. Provide at least one (1) hanger per branch.

3.08 LABELING AND IDENTIFYING

A. Provide pipe, valve, and equipment identification, and signage in accordance with referenced standards, codes and specifications.

B. Provide pipe identifications every 50'-0" feet.

C. Pipe Identification: Epoxy paint stencil with 8" long white color field and ½" text size "CW" in green color text.

D. Provide brass valve tags with brass chain and "S" hook for all valves.

3.09 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. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

C. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

3.10 TESTING

A. Perform tests in the presence of authorities having jurisdiction. Provide all required labor, materials, equipment and connections and submit results for review. Repair or replace defective work and pay for restoring or replacing damaged work, due to tests, as directed. All equipment required for testing, including fittings for additional operating shall be provided by the Contractor.

B. After the inspection has been approved or portions thereof, certify in writing the time, date, name and title of the person reviewing the test. This shall also include the description of what portion of the system has been approved.

C. A complete record shall be maintained of all testing that has been approved, and shall be made available at the job site.

D. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Port’s Representative before final payment is made.

E. Defective work or material shall be replaced or repaired, as necessary, and the inspection and test repeated. Repairs shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

F. Protection: Isolate all equipment subject to damage from test pressure. Make no test against a service valve or meter.

G. No part of any work shall be concealed or covered until after it is inspected, tested and approved by the Inspector. All piping for plumbing shall be completely installed and tested as required by the Plumbing Code. The test pressures indicated are a minimum only. All tests shall be as required by the governing authority as well.

3.11 PIPE DISINFECTION

A. Supervision and Testing: Supervision and Testing: Perform disinfection under Plumbing Inspector's supervision. Disinfections shall be subject to written approval upon receipt of satisfactory laboratory test results.

B. Contractor's Responsibility: Furnish labor, equipment, materials and transportation to disinfect domestic hot and cold water systems, recycled water system and fire lines directly connected thereto, in conformity with procedures and standards described herein.

C. Disinfecting Agent: Use an aqueous solution of sodium of calcium hypochlorite having at least 5.25% available chlorine. The use of powered hypochlorite is prohibited unless specifically approved by Health Department.

D. Preliminary Preparations:

1. Service Cock: Provide within three feet (3’) of the entrance of the supply main to the building, a three-fourths inch (¾") service cock, or valve, for the purpose of introducing the disinfecting agent into the lines.

2. Flushing: After final pressure tests and before draining for disinfection, open each fixture or outlet until the water flow is clear.

E. Disinfection Procedure:

1. Drain entire domestic water and recycled water systems, including fire line.

2. Post suitable warning signs at each outlet: "Warning" Do Not Use "Water System Being Chlorinated".

3. Inject disinfection solution into the system through the service cock by means of a pump, or other pressure device, at a slow continuous rate, simultaneous with a reduced flow from the water main, until the orthotolidin test for residual chlorine at each outlet shows a concentration of at least 50 ppm.

F. Close all outlets and valves, including the service valve at the main and the injection cock. Retain the chlorinated water in the system for twenty-four (24) hours.

G. After the twenty-four (24) hour holding period, the residual chlorine concentration shall be not less than fifty (50) ppm as shown by the orthotolidin test.

H. Drain and flush entire domestic water and recycled water systems until orthotolidin tests show a residual chlorine concentration of not more than 0.5 ppm at any outlet.

I. Health Department will take samples of water for the determination of bacteriological quality.

J. Standards Necessary for Approval:

1. The water system shall have been uniformly chlorinated under the supervision of Plumbing Inspector.

2. The results of water sample analysis shall be negative for the Coliform Aerogenes organisms, with a coliform MPN of less than 2.2 and a total plate count of less than 100 bacteria per milliliter.

3. If the test for the bacteriological quality of the water in the system does not meet the standards, repeat the disinfection procedure until the specified standards are met.

K. Final Approval: Health Department will give written approval for acceptance and use of the water system after the above procedures have been successfully completed and the standards met.

L. For temporary hook-ups, use the following disinfection procedure: This procedure is also to be used on repair of PVC-C900 and ductile iron water mains. All fittings and piping are to be disinfected.

1. Hoses to be used only for potable water use.

2. Hoses to be used must be stored in a clean, dry area.

3. Disinfectant mixture = one-half (½) cup HTH to three (3) gallons water.

4. Fill hose with disinfectant mixture and hold for one (1) hour.

5. Flush hose after one hour with clean, potable water.

6. Connect hose, avoiding any contaminant, mud, water, or touching the inside of connections.

7. When through, disconnect and store properly.

M. Upon completion of the work, all records and certifications approving pipe disinfections shall be submitted to the Port's Representative before final payment is made.

3.12 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service. Valves shall be replaced if persistent leaking occurs.

4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

5. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 26 05 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work included: Provide all required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, test equipment, and appurtenances, and satisfactorily complete all electrical work included in these Specifications or required for a complete and fully operating facility.

1.02 QUALITY ASSURANCE

A. Codes: All electrical equipment and materials, including installation and testing, shall conform to the following applicable codes:

1. National Electrical Code (NEC), latest edition

2. California Electrical Code, latest edition

3. National Electrical Safety Code (NESC), latest edition

4. Occupational Safety and Health Act (OSHA) standards

5. Rules for Construction of Underground Electric Supply and Communication Systems, General Order No. 128, Public Utilities Commission of the State of California, (G.O. 128), July 1974 edition; Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, International Electrical Testing Association (NETA), 91 or latest edition.

B. Variances: In instances where two or more codes are at variance, the most restrictive requirements shall apply.

C. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), and Institute of Electrical Manufacturers Association (NEMA). The revisions of these standards in effect on the date of issuance of the Contract Documents shall apply.

D. Underwriters Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories.

1.03 INSPECTION OF THE SITE AND EXISTING CONDITIONS

A. After award of contractor, verify the location of existing below deck/below grade utilities. Protect all existing below deck/below grade utilities during construction.

1.04 DRAWINGS

A. Drawing: The electrical drawings are diagrammatic and show only general locations of equipment, devices and raceway, unless specifically dimensioned; exact locations of

electrical products shall be verified in the field with the Port contract manager. The contractor shall be responsible for the proper routing of raceway due to actual field conditions, subject to the approval of Port Project Manager. Electrical drawings do not attempt to show complete details of building construction that affect installation. Diagrams are schematic only and do not necessarily show physical arrangement of equipment. Refer to drawings of other trades for additional details, which affect work.

B. As-Built Conditions:

1. Maintain a complete and accurate record of As-Built conditions for the Electrical construction work.

2. Record all work that is installed.

3. Upon completion of the work, submit to the Project Manager a complete description, including exact measurements, of the electrical work performed.

4. Locate all below deck/below grade conduits by accurate field-measured dimensions from walls and corners, etc., of surrounding structures.

1.05 SUBMITTALS

A. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port's Project Manager.

B. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

C. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port and handover a model with attribute data and CAD drawings to the Port's Representative.

D. Materials List: Submit manufacturer's catalog cuts as product data for each item installed. The catalog cuts shall include the manufacturer's name and provide sufficient information to show that the materials meet the requirements of the Specifications. Where more than one item or catalog number appears on a catalog cut, clearly identify the specific item(s) or catalog number(s) proposed.

1.06 FACTORY TESTS

A. Submit reports of factory tests and adjustments performed by equipment manufacturers to the Airport Project Manager prior to field testing and adjustment of the equipment. These reports shall identify the equipment and show dates, results of tests, measured values and final adjustment settings.
Provide factory tests and adjustments for equipment where factory tests are specified in the equipment Specifications.

1.07 COORDINATION

A. Coordinate the electrical work with other trades, code authorities, utilities, and the Port. General Contractor and Electrical Contractor shall coordinate all electrical requirements to ensure that all work can function as intended

B. When two trades join together in an area, make certain that no electrical work is omitted.

1.08 POWER SHUTDOWNS

A. General:

1. Carry out operations in a manner which will minimize power shutdowns.

2. All power shutdowns are subject to the Shutdown Procedure described below.

B. Shutdown Procedure

1. Application: This procedure applies to all electrical facilities within project site.

2. Purpose: Purpose of this procedure is primarily to protect safety of workmen involved and general public, and secondarily to coordinate construction work so that service interruptions will be held to an absolute minimum.

3. Responsibilities: It will be the duty of the Contractor to read and comply with this procedure and to inform all agents and employees of this procedure.

4. General Requirements: All electric service interruptions shall be subject to following requirements:

a. All switching operations of existing electrical equipment shall be performed by or under supervision of Port Representatives.

b. Service interruptions shall be held to a minimum.

c. Inquiry and preliminary scheduling of medium voltage or major power shutdown shall be made before submitting written request for shutdown.

d. Work may be terminated before completion and service temporarily restored at any time as directed Port Representative at no expense to the Port.

e. Contractor shall follow approved work phasing sequence and other specific directives of the Project Manager.

1.09 WORKMANSHIP

A. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.

B. Perform all labor using qualified craftsman, who have had experience on similar projects. Provide first-class workmanship for all installations.

C. All equipment shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

D. Ensure that all equipment and materials fit properly in their installations.

E. Perform any required work to correct improperly fit installations at no additional expense to the Port.

1.10 EXCAVATION AND BACKFILL

A. Provide the excavations for electrical equipment foundations and trenches for conduits as required.

B. Exercise caution during all excavation work and avoid damage to existing underground near existing utilities. Field verify the location of all utilities before proceeding with any nearby work.

1.11 INSTALLING EQUIPMENT

A. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.

B. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel. Provide type 316 stainless steel fasteners in corrosive locations. When fastening to existing walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is 3/8-inch.

C. All Unistrut supports, fittings and accessories exposed to weather and exposed below deck shall be stainless steel type 316.

1.12 CUTTING, DRILLING, AND WELDING

A. Provide the required cutting, drilling, and welding that is required for the electrical construction work.

B. Structural members shall not be cut or drilled. Use a core drill wherever it is necessary to drill through concrete or masonry.

C. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel.

D. Perform patch work with the same materials as the surrounding area and finish to match.

1.13 PROTECTIVE DEVICE COORDINATION AND ARC FAULT ANALYSIS

A. The Contractor shall pay all costs of engaging the services of a recognized independent testing laboratory or coordination analysis consultant for the proper system coordination of the protective devices and Arc Fault Analysis furnished on this project. The Contractor shall submit the name and qualifications of the laboratory or consultant for review and approved by Port Representative.

B. The protective device on the line side closest to the fault or abnormal conditions shall isolate the problem portion of the system and minimize damage in that portion. The rest of the system shall be maintained in normal service. The coordination shall be in conformance with the recommendations of latest IEEE Standard 242.

C. The Contractor shall submit to the Port Project Manager for a review the analysis which shall include impedance and short circuit calculations, list of any assumptions made in the analysis, the recommended settings of the protective devices and the system time/current

characteristic curves. The submittal shall be made so as to allow time for review and resubmittal, if necessary before the implementation of final settings and adjustments by the testing laboratory.

1.14 FIELD TESTS

A. Tests shall be in accordance with applicable procedures as described in NETA Acceptance Testing Specifications.

B. Give sufficient notice to the Port Project Manager prior to any test so that he may witness the test.

C. Provide the services of a recognized independent testing laboratory and pay all costs of performing the inspections and tests as specified herein.

D. The testing laboratory shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections. It is the intent of these tests to assure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with the Contract Documents and manufacturer's instructions. The tests and inspections shall determine the suitability for energization.

E. The testing laboratory shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907. Membership in the International Electrical Testing Association (NETA) constitutes proof of these qualifications to the Port Project Manager for review. Testing laboratory shall be Electrical Testing and Controls, Electro-Test, Power Systems, or equal.

F. Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior and in addition to tests performed by the testing laboratory specified herein. Supply a suitable and stable source of test power to the test laboratory at each test site. The testing laboratory shall specify requirements. Notify the testing laboratory when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling. All testing shall be performed in the presence of the Port Project Manager. The testing laboratory shall be responsible for implementing all final settings and adjustments on protective devices and tap changes. Any system material or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the Port Project Manager. The testing laboratory shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.

G. The testing laboratory shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:

1. Field instruments - 6 months maximum

2. Laboratory instruments - 12 months

3. Leased specialty equipment - 12 months

4. Date calibration labels shall be visible on all test equipment.

H. Where testing pursuant to NETA requirements is required in these specifications, submit a test report which includes the following:

1. Summary of project

2. Description of equipment tested

3. Description of test

4. List of test equipment used in calibration and calibration date

5. Test results

6. Conclusions and recommendations

7. Appendix, including appropriate test forms

a. The test report shall be bound and its contents certified. Submit five (5) copies of the completed report directly to the Port Project Manager no later than thirty (30) days after completion of the test unless directed otherwise.

I. Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act– OSHA

2. Accident Prevent Manual for Industrial Operations, Latest Edition, National Safety Council, Chapter 4

3. Applicable state and local safety operating procedures.

J. All field tests shall be performed with apparatus de-energized except where otherwise specifically required by Section 8 of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. The testing laboratory shall have a designated safety representative who shall be present on the project and supervise operations with respect to safety. Circuits operating in excess of 600 volts between conductors shall have conductors shorted to ground by a hot-line grounded device approved for the purpose. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so. The testing laboratory shall have available sufficient protective barriers and warning signs to conduct specified test safely.

K. Electrical equipment and materials furnished and installed by the Contractor, and the testing equipment listed below shall be tested in accordance with the "Inspection and Test Procedures" and "System Function Tests" (Section 8) of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. Tests shall not include any tests listed as optional in the aforementioned NETA Specifications unless specifically noted in respective equipment specifications for this project.

L. Retesting will be required for all unsatisfactory tests after the equipment or system has been repaired. Retest all related equipment and systems if required by the Port Project Manager. Repair and retest equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.

M. Putting Equipment and Cables into Service: Submittal and favorable review of the specified factory and field tests shall occur before the Contractor is permitted to place the respective equipment or cable into service.

1.15 CLEANING EQUIPMENT

A. Thoroughly clean all soiled surfaces of installed equipment and materials.

1.16 CLEAN-UP

A. Upon completion of the electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Port Project Manager.

END OF SECTION

SECTION 26 05 01

BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. The requirements of this Section apply to all work under electrical work under where applicable.

B. Wiring shall be installed under this Section. Material shall include the following:

1. Raceways, boxes and associated fittings

2. Wire and Cable

C. Related Sections include the following:

1. Standards and Criteria for General Electrical Requirements.

1.02 SUBMITTALS

A. Provide shop drawings for the following items:

1. Conduits and fittings

2. Pullboxes

3. Wire and splicing material

4. Wiring devices

5. Cable support and conduits support

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Raceways shall be provided for all conductors, including communications and low energy control circuits unless otherwise specified herein or noted on the drawings.

B. Raceways shall be hot-dipped galvanized rigid steel conduit unless otherwise specified herein or noted on the drawings.

C. Conduits and Tubing

1. Minimum conduit size shall be 3/4 inch.

2. Rigid conduit shall be full weight steel pipe, hot-dipped galvanized and threaded.

3. Electrical metallic tubing (EMT) shall be steel thin wall pipe.

4. Flexible steel conduit shall be continuous single strip, galvanized. Flexible conduits in exterior locations, locations below ground level and in any damp or wet locations shall be PVC covered liquid-tight.

5. Fittings:
   a. Fittings for rigid conduit shall be threaded type.
   b. Fittings for electrical metallic tubing shall be all steel bodied compression type.
   c. Fittings for flexible conduit shall be one piece cast screw-on type or dual screw clamp type. Fittings for liquid-tight flexible conduit shall be compression type.

D. Direct buried rigid steel conduit and fittings shall be permanently coated with 40 mil PVC coated conduit shall meet applicable NEMA requirements.

E. Boxes

1. Boxes in interior dry locations shall be stamped galvanized steel with knockouts unless otherwise specified.

   a. Switch and receptacle outlet boxes shall be 4 inch square, 1-1/2 inch deep unless larger size is required.

   b. Lighting fixture outlet boxes shall be 4 inch octagon, 1-1/2 inch deep.

   c. Junction boxes shall be 4 inch square, 1-1/2 inch deep minimum.

2. For indoor locations, boxes where noted to be larger than available stamped boxes shall be galvanized code gauge sheet steel with screw on covers.

3. Concrete boxes shall be as noted on the drawings.

4. Boxes intended for outdoor and wet locations shall be cast ferrous type, galvanized unless otherwise specified. Special finished shall be required in certain areas as designated on the drawings. Provide with threaded hubs and gaskets.

2.02 WIRE AND CABLE

A. Low Voltage Cable (600 volts and under)

1. Low voltage wires for general wiring shall be copper conductor of the type and size shown on the drawings and specified herein with thermoplastic insulation of 600 volt rating and 90 degree C temperature rating. Wire shall conform to IPCEA Publication No. S-61-402 (NEMA Publication WC5-1973) with additions as detailed in this specification.

   a. Copper conductors shall be annealed uncrated or coated copper wire.

   b. Conductors 12AWG shall be solid and conductors 10 AWG and larger shall be stranded.

   c. Unless otherwise specified, conductor types for each application shall be as noted below:

Feeder and Underground Circuits	THWN rated at 90˚C
Branch Circuits	THWN rated at 90˚C
Control	THWN rated at 90˚C
In Switchboards	Stranded rated at 90˚C
Branch Circuits into or thru lighting fixtures	THHN, THWN rated at 90˚C

d. Color Coding: All power conductors shall be color coded by outer jacket or by vinyl tape according to the following schedule:

1) 120/208 volt ungrounded conductors
(A) Black, (B) Red, and (C) Blue.

2) 277/480 volt ungrounded conductors
(A) Brown, (B) Orange and (C) Yellow

PART 3 - EXECUTION

3.01 INSTALLATION OF RACEWAYS

A. Raceways shall be provided for all conductors, including communications and low energy control circuits unless otherwise specified herein or noted on the drawings. Raceways shall be installed parallel or perpendicular to building members and concealed in finished areas.

B. All feeders shall run in rigid conduit. Conduits embedded in concrete, exposed in exterior locations, or exposed in interior locations and less than eight feet above floors or platforms shall be rigid steel. Conduits in hollow concealed spaces or exposed in interior locations more than eight feet above floors or platforms may be steel electrical metallic tubing.

C. Conduits to recessed lighting fixtures shall be flexible steel conduit at least four and a half feet but not exceeding six meet in length and supported not more than three feet from either end.

D. Conduits to motors or other equipment where vibration isolation or adjustments or flexibility is required shall be flexible steel conduit not exceeding three feet in length. Flexible conduits in exterior locations, locations below ground level and in any damp or wet locations shall be liquid-tight flexible steel conduit.

E. Supports

1. Spacing shall be a maximum of 10-feet on center for metallic conduit and 5-feet on center for wire ways.

2. Supports shall be mounted to structure with:

a. Toggle bolts on hollow masonry.

b. Expansion shield or insets on concrete.

c. Machine screws on metal.

d. Nails, raw plugs or wood plugs shall not be permitted.

3. Raceway shall not be attached to machinery or equipment (e.g., conveyors, air ducts) except at point of service to motors, control devices, etc.

4. Raceways shall not be supported by suspended ceiling wires or on ceiling but shall be separately by building structure, except that ceiling lighting branch circuit conduits only may be run on main ceiling capered members with approved standoff clamps.

F. All flexible conduit sections shall be bypassed, either inside or outside, with insulated copper ground wire sized in relationship to the circuit in accordance with Table 250-95 of the National Electrical Code.

G. Pipe joint compounds used on raceways shall be conducting type.

H. Rigid conduits terminating at a box or enclosure without threaded hubs shall be terminated with two locknuts, one inside and one outside, and a steel bushing. Ground continuity between conduit and boxes and enclosures shall be maintained.

I. All conduit penetrating roofs shall be provided with flashing collars sealed to conduit and counter-flashed with roofing material.

J. Raceway penetrations of air plenums shall be completely sealed.

K. Raceways shall not penetrate or pass through air ducts.

L. Empty raceways shall be provided with identification tags in each pull box and junction box showing origin of raceway run.

M. Raceway shall be cut with a hacksaw or machine saw, no wheel cutter shall be allowed. Inside cross-section area shall not be reduced due to cutting, cut ends shall be reamed to remove burrs and sharp edges.

N. Conduit shall be bent with standard bending equipment.

O. Raceways shall be located not closer than 12 inches from uninsulated parallel steam or hot water lines, 6 inches from uninsulated crossing steam or hot water lines, and 2 inches from insulated steam or hot water lines; and shall be installed below such lines.

P. Conduits terminating at concentric or eccentric knockouts or oversized holes shall be bonded to box, cabinet or equipment enclosure by means of grounding bushing and bonding wire.

Q. Installation of Conduit in Structures:

1. Conduit embedded in concrete structures shall not, with fittings, displace more than four percent (4%) of area of cross section of column. Embedded conduits, other than those merely passing through, shall not be larger in outside diameter than one-third (1/3) of thickness of slab, wall or beam in which embedded, nor shall they be spaced closer than three diameters of larger conduit on center; or so located as to unduly impair strength of construction. Concrete covering of conduits and fittings shall be 1-1/4inch minimum.

2. Conduits or sleeves passing through slabs, walls or beams shall be placed as not to unduly impair strength of construction.

3. Conduits or sleeves passing through slabs, walls or beams larger than two inches inside diameter or spaced less than three diameters of largest conduit on center, shall be installed only when specifically permitted by the Engineer.

4. Metal conduits penetrating concrete slabs, walls or beams, at or below grade level or in any damp or wet location, shall be wrapped or coated a minimum of three inches on each side of air-concrete interface.

R. Electrical raceways shall be identified by self-adhering, non-conductive markers with orange background and black letters. Lettering shall be printed or field applied by felt tip pen. Field applied lettering shall be covered with clear tape. Markers shall be placed on all exposed or accessible raceways within 18 inches of raceway termination, wherever raceway enters or leaves concealed space, and every 50 feet along raceway. Markers shall be 1/2 inch by 2-1/4 inches for conduits up to 1-1/4 inch nominal size; 1-1/8 inch by 4-1/2 inches for conduit 1-1/2 inch nominal size and larger and all other raceways. Markers shall be Brady or equal.

1. Power and lighting raceways shall be identified as to system voltage between phases, and to ground if system is grounded.

2. Emergency Raceways shall be identified "Emergency Service" in addition to system voltage.

3. Ground Raceways shall be identified "Ground".

4. Fire alarm raceways shall be "Fire Alarm".

5. Low voltage control raceways shall be identified "Low Voltage".

6. Raceways reserved for communication shall be identified "Communication".

7. Data system raceways shall be identified "Data.".

8. Miscellaneous control systems raceways shall be identified "Control".

9. Other raceways shall be identified as directed by the Engineer.

S. Raceways located underground beyond building shall be as follows:

1. 36 inch minimum top cover; slope away from building at a minimum slope of 3 inches per hundred feet.

2. At building or equipment entry (exterior locations) and at manholes or pull boxes, terminate empty raceways with bushing plugs. Seal cables in raceways with terminators,
similar to O.Z. "C" series or appropriate foam sealant as directed by the Engineer.

T. Outlet boxes; install square and true with building finish and secured to building structure.

U. Junction and Pull Boxes:

1. Install clear of other work, maintain accessibility.

2. Support from building structure independent of conduit.

3.02 INSTALLATION OF WIRE AND CABLE

A. Low Voltage Cable (600 Volts and under)

1. Raceways shall be installed complete and cleaned and mandrelled prior to pulling of wires.

2. Pulling tension on wires shall not exceed 0.008 pounds per circular mil area for copper conductors.

3. Only approved wire lubricants shall be used.

4. Care shall be taken to avoid kinks and sharp bends in pulling wires.

5. Splices shall be as follows:

a. Wires #8 AWG and larger shall be spliced with compression sleeve connectors with tool designed so that full compression must be applied before tool released. Wires of different sizes shall be spliced with one-hole crimped lugs. Splices shall be insulated with Scotch pre-shrunk tubing or layers of Scotch 33 + tape, half lapped built up to 1-1/2 times wire insulation thickness.

b. Wires #10AWG and smaller for power and control circuits shall be spliced with either compression sleeve connectors as in (a) above or Scotchlok connectors (copper conductors or lighting fixtures connections only).

c. Splices in underground or wet locations shall be Scotchcast or otherwise sealed in an approved waterproof epoxy casing.

6. Tests

a. All feeders shall be tested for mechanical and electrical properties, including grounds, shorts, leakage, continuity and tightness of connections.

b. All panel boards and branch circuits shall be tested for grounds and shorts with mains disconnected from feeders, branch circuits connected, circuit breakers closed, all fixtures in place and permanently connected (without lamps or ballasts connected), and all switches closed.

c. The insulation resistance of each circuit, phase to phase and phase to ground shall be measured as follows:

1) Systems rated above 240 volts shall be tested with a 1000 volt D.C. and minimum insulation resistance in 100 megohms; system rated 240 volts and below shall be tested with a 500 volt D.C. and minimum insulation resistance in 25 megohms.

2) Motor feeders shall be measured with motor disconnected.

3) Line voltage control circuits shall be measured with pushbutton, interlocking relays, instruments, overcurrent devices and the like connected.

4) All measurements shall be recorded on standard test forms. Any measurement of less than 10 megohms shall be immediately called to the attention of the Engineer for final decision of acceptability.

5) A written report of the test results shall be submitted and approved by the Engineer before the systems are placed in service. Each circuit at the panel board shall be tested for proper operation with its normal load connected.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provisions: Applicable provisions of Section 26 become a part of this Section as if repeated herein.

B. This section includes building wires and cables rated 600 V and less, connectors, splices and terminations rated 600 V and less.

C. Related Work Described Elsewhere:

1. Drawings, documents, and general provisions of the Contract, including but not limited to General Conditions, apply to this Section.

2. General Electrical Requirements: Section 26 05 00

3. Control-Voltage Electrical Power Cables: Section 26 05 23

4. Conduit, Raceway and Fittings: Section 26 05 34

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publications:

1. B3-74 (1980): Specification for soft or Annealed Copper Wire

2. B-8-77: Specification for Concentric Lay Stranded Copper Conductors, Hard, Medium- Hard, or Soft

3. B173-71: Specification for Rope Lay Stranded Copper (R 1980) Conductors Having Concentric Stranded Members

B. Insulated Cable Engineers Association (ICEA):

1. S-66-524: Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable

C. Underwriters Laboratories (UL) Standards:

1. 44-1986: Rubber Insulated Wire and Cable

2. 62-1987: Flexible Cords and Fixture Wire

3. 83-1986: Thermoplastic-Insulated Wires and Cables

4. 510-1986: Insulating Tape

5. 719-1985: Non-Metallic Sheath Cable

6. 1063-1986: Stranded Conductors for Machine Tool Wire

D. National Fire Protection Association (NFPA) 270

E. Nationally Recognized Testing Laboratory (NRTL)

F. National Electrical Manufacturers Association (NEMA)

G. National Electrical Code (NEC)

1.03 SUBMITTALS

A. General:

1. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port of San Francisco Project Manager.

2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

3. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port of San Francisco and handover a model with attribute data and CAD drawings to the Port of San Francisco.

B. Catalog & Product Data: Provide Manufacturers published descriptive literature properly marked for each type of product indicated.

C. Single Submittal: A single complete submittal is required for all products covered by this Section.

D. Qualification Data: For testing agency.

E. Field quality-control test reports.

1.04 LOCATIONS

A. Refer to General Electrical Requirements, for definitions of types of locations.

PART 2 – PRODUCTS

2.01 GENERAL

A. All conductors shall be copper. Wire or cable not specially shown on the Drawings or specified, but required, shall be of the type and size required for the application and in conformance with the applicable code. All insulated conductors shall be identified with printing colored to contrast with the insulation color. All copper conductors must comply with

NEMA WC 70.

1. Conductor insulation must comply with NEMA WC 70 for types THHN-2, THWN-2, and SO.

2. Multi-conductor cable must comply with NEMA WC 70 for metal-clad cable, Type MC and with ground wire.

B. Power and Control Conductors, 2,000 Volts and Below:

1. 600 volts copper wires shall be UL and NEC approved, Types TW, THW, XHHW or dual rated THHN-THWN, 90 ºC rated only.

2. Cord service, of adequate length and with grounding type plug attached, shall be rated in amperes suitable for the temporary service being connected as shown on the contract drawings.

3. No MC cable is permitted.

C. Material Applications:

1. Feeders: Copper. Stranded.

2. Branch Circuits: Copper. Stranded or solid.

3. Fire Alarm System: Copper, solid.

D. Available Manufacturers Conductors and Cables: Subject to compliance with requirements:

1. American Insulated Wire Corp.; A Leviton Company.

2. General Cable Corporation.

3. Senator Wire & Cable Company.

4. Southwire Company.

2.02 SPLICES AND TERMINATIONS OF CONDUCTORS

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. Splices:

1. Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly. They shall be UL listed and suitable for connecting two to four solid copper conductors of #14 or #12 AWG size or two or three #10 AWG solid copper conductors of #14 or #12 AWG size or two or three #10 AWG solid copper conductors.

2. Crimp type connectors shall be sleeve type, suitable for the size and material of the wires and the number of wires to be spliced and for use with either solid or stranded conductors. They shall be UL listed.

3. Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced. They shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.

4. Epoxy splice kits shall include epoxy resin, hardener, and mold, and shall be suitable for use in wet locations.

C. Low Voltage Terminations:

1. Crimp type terminals shall be UL listed, self-insulating sleeve type, with fork type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.

2. Terminal lugs shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor. Tongues shall have NEMA standard drilling.

D. Tape used for splices and terminations shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform with UL 510.

E. Wire markers shall be vinyl cloth adhesive type, or plastic sleeve type. Wire numbers shall be permanently imprinted on the markers.

F. Available Manufacturers: Subject to compliance with requirements:

1. AFC Cable Systems, Inc.

2. Hubbell Power Systems, Inc.

3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.

PART 3 - EXECUTION

3.01 CONDUCTOR INSTALLATION

A. Provide the following types and sizes of conductors for the uses indicated for 600 volts or less:

1. Solid Copper, Sizes #12 AWG and smaller: As shown on the Drawings for circuits for receptacles, switches and light fixtures with screw-type terminals.

2. Stranded Copper, sizes #10 AWG and larger: As shown on the drawings for motors and other power circuits.

3. Fixture Wire: For connections to all fixtures in which the temperature may exceed the rating of branch circuit conductors.

B. Color Coding: Provide color coding for all circuit conductors. Insulation color shall be white for 120V and grey for 277V neutrals, and green for grounding conductors. An isolated ground conductor shall be identified with an orange tracer in the green body. Ungrounded conductor colors shall be as follows:

1. 120/208 Volt, 3 Phase: (A) black, (B) red, (C) blue

2. 277/480 Volt, 3 Phase: (A) brown, (B) orange, (C) yellow

C. Exercise care in pulling wires and cables into conduit or wire ways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

E. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length unless splices are favorably reviewed.

F. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any flexible conduit or any raceway in which all or any portion of a run consists of non-metallic duct or conduit. For flexible conduit, an external bonding jumper is an acceptable alternative.

G. In panels, bundle incoming wire and cables, No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

H. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups Not exceeding 12, and arrange so that they will be protected from chafing when the hinged member is moved.

I. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

J. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

K. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

L. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2, THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2, THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2, THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2, THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2, THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2, THWN-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless- steel, wire-mesh, and strain relief device at terminations to suit application.

I. Branch Circuits in Cable Tray: Type THHN-2-THWN-2, single conductors in raceway.

J. Class 1 Control Circuits: Type THHN-2, THWN-2, in raceway.

K. Class 2 Control Circuits: Type THHN-2, THWN-2, in raceway.

3.3 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice or terminate wire and cable as follows:

1. Watertight Splices: Splices in concrete hand holes and manholes, for any type of cable or wire, shall be watertight. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.

B. Terminations:

1. Terminate stranded wire using spade terminals, or equal, where not terminated in a box lug type terminal.

C. Connections

1. 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 and UL 486B.

2. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

a. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

3. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.04 CONDUCTOR IDENTIFICATION

A. Low voltage cable identification tags shall be provided for all cables in each manhole, vault, tunnel, pull box and all exposed locations.

B. Tags shall be 1/8" thick, 1-1/2" x 7", 3 ply weather-resistant rigid laminated phenolic as manufactured by Hermes Plastics, Inc. or equal. A 1/4" diameter hole shall be drilled 1/2" from each end of tag to facilitate attachment of tag to cable.

C. Tags shall have red surface with white core bearing the name of the cable as designated.

D. Install an identification tag with cable designation on each conductor with nylon tie-wrap over the cable arc-proof wrapping. Tags shall be installed in each manhole and on all cable of WIRE type splices. Phase letters shall be included in the cable designations.

3.05 FIRESTOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to "Penetration Fire stopping Systems" requirements.

3.06 FIELD TESTS

A. Testing Agency Qualifications:

1. Engage an independent agency, with the experience and capability to conduct the testing indicated, inspections, and prepare test reports, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 FR 1910.7 and that is acceptable to authorities having jurisdiction.

2. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with NFPA 70.

C. Insulation Resistance Tests: Perform insulation resistance tests on circuits to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. For 120 and 208 volt wiring, test the insulation with a 500 Vdc insulation resistance tester with a scale reading 100 megohms. For 480 volt wiring, test the insulation with a 1000 vdc insulation resistance tester. The insulation resistance shall be 20 megohms or more. Submit results for review.

D. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Phase Rotation: The phase rotation of all circuits shall be clockwise in sequence. The Contractor shall verify that each three-phase service, feeder and branch circuits meet this requirement. A record shall be kept at each circuit tested and, on completion, given to the Engineer for review.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger.

1. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial actions.

G. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

H. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes methods and materials for grounding systems and equipment, including:

1. Active electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

B. Related Sections:

1. Site Grounding: Site related grounding components for buildings and facilities.
2. Access Flooring: Grounding systems for access flooring.
3. Drawings, documents, and general provisions of the Contract, including but not limited To General Conditions, apply to this Section.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. National Electrical Code (NEC)

1.03 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal building frame.
2. Concrete-encased electrode.
3. Ground ring.
4. Rod electrode.
5. Plate electrode.

1.04 DESIGN REQUIREMENTS

A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: Less than 5 ohms.

1.06 SUBMITTALS

A. As per Submittal requirements.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground.

D. Shop Drawings:

1. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port Project Manager.

2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

E. Qualification Data: For testing agency and testing agency's field supervisor.

F. Field quality-control test reports.

G. Manufacturer's Installation Instructions: Submit for active electrodes.

H. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

I. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.

2. Ground rods.

3. Grounding arrangements and connections for separately derived systems.

4. Grounding for sensitive electronic equipment.

J. Operations and maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells And grounding connections for separately derived systems based on NETA MTS.

a. Tests shall be determined if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.

b. Include recommended testing intervals.

1.07 CLOSEOUT SUBMITTALS

A. As per Contract Closeout and Project Record Documents requirements.

B. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port and handover a model with attribute data and CAD drawings to the Port.

1.08 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL label. Comply with UL 467 for grounding and bonding materials and equipment.

B. Perform Work in accordance with NEC and/or SFO-TIG

C. Maintain two copies of each document on site.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years' experience.

B. Installer: Company specializing in performing work of this section with minimum five years' experience approved by manufacturer.

C. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.10 PRE-INSTALLATION MEETINGS

A. As per requirements of Project Meetings.

1.11 DELIVERY, STORAGE, AND HANDLING

A. As per requirements of Material and Equipment.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.12 COORDINATION

A. As per requirements of Work Coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 – PRODUCTS

2.01 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; ¾ inch by 120 inches.

B. Manufacturers: Subject to compliance with requirements, provide grounding products of one the following:

1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. O-Z Gedney Co.
5. Thomas & Betts, Electrical Corp.
6. Or Engineer approved equal.

C. Furnish materials in accordance with NEC.

2.02 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: As shown on drawings.

C. Grounding Electrode Conductor: Copper conductor bare or insulated.

D. Bonding Conductor: Copper conductor bare or insulated.

2.03 MECHANICAL CONNECTORS

A. Manufacturers:

1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. ILSCO Corporation.
5. O-Z Gedney Co.
6. Thomas & Betts, Electrical.
7. Or Engineer approved equal.

B. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

C. Furnish materials in accordance with NEC.

D. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

1. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure- type, with at least two bolts.
2. Pipe Connectors: Clamp type, sized for pipe.
3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
4. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solder less compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.04 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Apache Grounding/Erico Inc.
2. Cadweld, Erico, Inc.
3. Copperweld, Inc.
4. ILSCO Corporation.

5. O-Z Gedney Co.

6. Thomas & Betts, Electrical.

7. Or Engineer approved equal.

B. Furnish materials in accordance with NEC.

C. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.05 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Stranded Conductors: ASTM B 8.

2. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

4. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1- a. 5/8 inches wide and 1/16 inch thick.
5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated With copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, Size as indicated on plans; with insulators.

PART 3 - EXECUTION

3.01 EXAMINATION

A. As per Job Site Administration requirements.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.02 PREPARATION

A. Remove paint, rust, mill oils, and surface contaminants at connection points.

3.03 INSTALLATION

A. Conductors: Stranded copper unless otherwise indicated.

B. Install in accordance with IEEE.

C. Install additional rod electrodes to achieve specified resistance to ground.

D. Install grounding and bonding conductors concealed from view.

E. Install grounding well pipe with cover at each rod location] [rod locations as indicated on Drawings. Install well pipes top flush with finished grade.

F. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings if applicable. Electrically bond steel together.

G. Bond together metal siding not attached to grounded structure; bond to ground.

H. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to ground bus and building ground grid. Install bare copper bonding conductor per NEC.

I. Connect to site grounding system.

J. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may
be subjected to strain, impact, or damage.

K. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any. from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

L. Test Wells: Ground rod driven through drilled hole in bottom of hand hole. Hand holes are specified in Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

M. Test Wells: Install at least one test well for each service, unless otherwise indicated.

N. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

O. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

4. Provide separate aircraft static grounding receptacle closest to aircraft grounding connection points. Ground resistance shall be 25 ohms or less. Stencil on the surface the install date and resistance achieved.

P. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

Q. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

R. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

S. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.

2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

T. PBB ground support electrical equipment shall have grounding bonded to building ground.

3.05 GENERAL GROUNDING

A. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

B. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panel boards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

C. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

D. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panel boards with installed number 12 conductor to grounding bus.

E. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

F. Permanently attach equipment and grounding conductors prior to energizing equipment.

G. Isolated Grounding Conductors:

1. Install conductor for circuits supplying personal computers in accordance with IEEE 1100.

2. Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

H. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally on insulated spacers 1 inch, minimum, from wall and 6 inches above finished floor, unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

I. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.06 UNDERGROUND GROUNDING CONDUCTORS AND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEE C2 grounding requirements.

B. Install bare tinned-copper conductor, No. 4/0 AWG minimum. Size grounding conductor per NEC.

C. Bury at least 24 inches below grade.

D. Duct bank grounding conductor shall be buried a minimum of 36 inches or encased in concrete along with the duct banks.

E. Grounding Manholes and Hand holes: Install a driven ground rod through manhole or hand hole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 4/0 AWG bare, tinned- copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure- sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout. Use ¾ " x 10' copper ground rod.

F. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or hand hole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductor's level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

G. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned- copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.07 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Terminate each end on suitable lug, bus, or bushing.

C. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.

2. Three-phase motor and appliance branch circuits.

3. Flexible raceway runs.

4. Armored and metal-clad cable runs.

5. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

D. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

E. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

F. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panel board grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panel board grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.08 FIELD QUALITY CONTROL

A. As per Quality Control and Contract Closeout requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform the following tests and inspections and prepare test reports:

1. Grounding and Bonding

a. Perform inspections and tests listed in NETA ATS, Section 7.13.

2. Perform ground resistance testing in accordance with IEEE 142.

3. Perform leakage current tests in accordance with NFPA 99.

4. Perform continuity testing in accordance with IEEE 142.

5. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

6. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

D. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

F. The neutrals of transformers, raceways, non-current carrying metal parts of fixed equipment and other equipment required to be bonded or grounded shall comply with NEC Section 250.

G. Ground clamps shall be installed so that they are readily accessible.

H. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

I. Coordinate with other work as necessary to interface installation of electrical grounding system.

J. Flexible metallic conduit raceway to fixed motors shall enclose a code sized grounding conductor in each case where the circuit conductors in the flexible conduit are larger than #12
AWG.

K. Provide code sized equipment ground wires in all conduit runs and bond all conduits and equipment ground at all location to building ground bus to obtain minimum impedance.

L. Report measured ground resistance that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).
4. Substations and Pad-Mounted Equipment: 5 ohms.
5. Manhole Grounds: 10 ohms.

M. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Fire stopping relating to electrical work.
7. Fire stopping accessories.
8. Equipment bases and supports.
9. Seismic Restraint System.
10. Hangers and supports for electrical equipment and systems.
11. Construction requirements for concrete bases.

1.02 REFERENCES

A. Comply with the latest versions of the following references:

1. American Society for Testing and Materials:

   a. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

   b. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

   c. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

2. Factory Mutual System (FM)- Approval Guide, a Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

3. National Fire Protection Association (NFPA) 70 - National Electrical Code (NEC).

4. Underwriters Laboratories Inc.:

   a. UL 263 - Fire Tests of Building Construction and Materials.

   b. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

   c. UL 1479 - Fire Tests of Through-Penetration Fire stops.

   d. UL - Fire Resistance Directory.

5. Warnock Hersey (WH) Certification Listings.

6. California Code of Regulations (CCR), Title 24, Building Standards.

   a. Part 6, Special Building Regulations.

   b. Chapter 8, Table T22-23-J.

7. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc.

   a. "Guidelines for Seismic Restraints of Mechanical System and Plumbing Piping Systems," No. R0010.

   b. "Superstrut Seismic Restraint System" for pipes and conduits only, No. R0003.

   c. "Kin-Line Seismic Restraint System" for pipes and conduits only, No. R0071.

8. American Welding Society (AWS) Standards

9. National Electrical Contractors Association (NECA).

1.03 DEFINITIONS

A. Fire stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

B. EMT: Electrical metallic tubing.

C. IMC: Intermediate metal conduit.

D. RMC: Rigid metal conduit.

1.04 SYSTEM DESCRIPTION

A. Fire stopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Fire stopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction in accordance with FM, UL, WH Surface Burning: ASTM E84, UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Fire stop interruptions to fire rated assemblies, materials, and components.

1.05 PERFORMANCE REQUIREMENTS

A. Fire stopping: Conform to applicable code FM, UL, or WH for fire resistance ratings and surface burning characteristics.

B. Fire stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

C. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

D. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

E. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.06 SUBMITTALS

A. General:

1. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the City Project Manager.

2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

3. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the City and handover a model with attribute data and CAD drawings to the City.

B. Submit six (6) copies of the information below.

1. Shop Drawings: Signed and sealed by a qualified professional engineer. Indicate system layout with location and detail of trapeze hangers. Show fabrication and installation details and include the following:

a. Trapeze hangers. Include Product Data for Components

b. Steel slotted channel systems. Include Product Data for components.

c. Equipment supports.

2. Product Data:

   a. Hangers and Supports: Submit manufacturers catalog data including load capacity.

   b. Fire stopping: Submit data on product characteristics, performance and limitation criteria.

   c. Steel slotted support systems.

   d. Nonmetallic slotted support systems.

3. Fire stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

4. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

4. Manufacturer's Installation Instructions:

   a. Hangers and Supports: Submit special procedures and assembly of components.

   b. Fire stopping: Submit preparation and installation instructions.

5. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

6. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

7. Welding certificates.

1.07 QUALITY ASSURANCE

A. General:

1. Anchor support, and brace all equipment and systems to resist seismic forces as specified hereinafter.

2. Comply with CCR Title 24.

3. Where anchorage support and bracing for various manufactured and systems are detailed and scheduled on the drawings, provide as shown.

4. For anchorage, support and bracing not detailed, provide in accordance with the Certified Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems.

5. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

6. Comply with NFPA 70.

B. Loads to be transmitted to the structure at anchor points.

1. Do not work involving anchorages and bracing specified herein until receipt Of Anchorage and Construction Details, from the Architect.

1.08 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements as specified.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations as specified.

1.09 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five years documented experience approved by manufacturer.

1.10 PRE-INSTALLATION MEETINGS

A. As per Project Meeting requirements.

1.11 DELIVERY, STORAGE, AND HANDLING

A. As per Material and Equipment requirements.

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B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.12 ENVIRONMENTAL REQUIREMENTS

A. As per Material and Equipment requirements.

B. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 ºF.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Channel Supports

1. Unistrut
2. Superstrut
3. Steel City/Kindorf
4. B-Line Systems
5. Or Engineer approved equal

B. Fasteners

1. Caddy
2. Steel City
3. T&B
4. Tomic
5. Or Engineer approved equal

C. Expansion Bolts

1. Hilti Red Head
2. SMACNA approved type
3. Or Engineer approved equal

2.02 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 ºF. Self-locking type.

2.3 SLEEVES

A. Sleeves for conduit through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for conduit through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

C. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.

2. NMP Corporation

3. Or Engineer approved equal

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.05 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.

2. Fire Trak Corp.

3. Hilti Corp.

4. International Protective Coating Corp.

5. 3M Fire Protection Products.

6. Specified Technology, Inc.

7. Or Engineer approved equal

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Fire stopping Elastomeric Fire stopping: Single component silicone elastomeric compound and compatible silicone sealant.

2. Foam Fire stopping Compounds: Single component foam compound.

3. Formulated Fire stopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

4. Fiber Stuffing and Sealant Fire stopping: Composite of fiber stuffing insulation With silicone elastomer for smoke stopping.

5. Mechanical Fire stopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars,penetration sealed with flanged stops.

6. Intumescent Fire stopping: Intumescent putty compound which expands on exposure to surface heat gain.

7. Fire Stop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer's full range of colors.

2.06 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by fire stopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Mineral fiberboard.

2. Mineral fiber matting.

3. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

2.07 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers:

   a. Allied Tube & Conduit.

   b. Cooper B-Line, Inc.; a division of Cooper Industries.

   c. ERICO International Corporation.

   d. GS Metals Corp.

   e. Thomas & Betts Corporation.

   f. Unistrut; Tyco International, Ltd.

   g. Wesanco, Inc.

   h. Or equal.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      1) Hilti Inc.

      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable For attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTMA 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

8. Materials: Provide type 316 stainless steel in corrosive locations/environment.

2.08 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in "Metal Fabrications" for steel shapes and plates.

PART 3 – EXECUTION

3.01 EXAMINATION

A. As per Job Site Administration requirements.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive fire stopping.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of fire stopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.03 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts , expansion anchors.

2. Steel Structural Elements: Provide beam clamps, steel ramset fasteners, and welded fasteners.

3. Concrete Surfaces: Provide expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.

5. Solid Masonry Walls: Provide expansion anchors and preset inserts.

6. Sheet Metal: Provide sheet metal screws.

7. Wood Elements: Provide wood screws.

8. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel. Provide type 316 stainless steel fasteners in corrosive locations. When fastening to existing walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is 3/8-inch.

B. Inserts:

1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through- bolt with recessed square steel plate and nut.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panel boards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panel boards1 inch off wall.

4. Support vertical conduit at every floor.

3.04 INSTALLATION – FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring fire stopping.

B. Apply primer where recommended by manufacturer for type of fire stopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply fire stopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Fire Rated Surface:

1. Seal opening at floor, wall, partition, and/or ceiling, as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

c. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, conduit, wire way or trough penetrates fire rated surface, install fire stopping product in accordance with manufacturer's instructions.

F. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition floor, and/or ceiling opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

d. Install type of fire stopping material recommended by manufacturer.

2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire Rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at equipment room. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.05 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

B. Install surface-mounted cabinets and panel boards with minimum of four anchors.

C. Construct supports of structural steel or formed steel channel. Brace and fasten with flanges bolted to structure.

D. Support Installation:

1. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

2. Raceway Support Method: In addition to methods described in ENCA 1, EMT, and IMC may be supported by openings through structure members, as permitted by NFPA 70.

3. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

4. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   a. To Wood: Fasten with lag screws or through bolts. b. To New Concrete: Anchor bolt to concrete inserts.

      1) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
      2) Install anchor bolts to elevations required for proper attachment to Supported equipment.

      3) Install anchor bolts according to anchor-bolt manufacturer's written instructions.

   b. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

   c. To Existing Concrete: Expansion anchor fasteners.

   d. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

   e. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   f. To Light Steel: Sheet metal screws.

   g. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panel boards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

5. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

E. Installation of Fabricated Metal Supports

1. Comply with installation requirements "Metal Fabrications" requirements for site-fabricated metal supports.

2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3. Field Welding: Comply with AWS D1.1/D1.1M

F. Painting

1. 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.

2. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

3. Touchup: Comply with requirements in Painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

4. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTMA A 780.

3.06 INSTALLATION – SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install escutcheons at finished surfaces.

3.07 FIELD QUALITY CONTROL

A. As per Quality Control requirements.

B. Inspect installed fire stopping for compliance with specifications and submitted schedule.

3.08 CLEANING

A. As per Contract Closeout requirements.

B. Clean adjacent surfaces of fire stopping materials.

3.09 PROTECTION OF FINISHED WORK

A. As per Contract Closeout requirements.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provision: Applicable provisions of General Electrical Requirements, become part of this section as if repeated herein.

B. Work included:

1. Installation of all necessary outlet boxes for wiring devices, lighting fixtures, and signal equipment as noted on drawings.

2. Installation of junction boxes as required for the consolidation of conduit runs.

3. Installation of pull boxes as necessary to aid in pulling conductors.

4. Installation of conduit transition cabinets as noted on the drawings.

C. Section Includes

1. Wall and Ceiling outlet Boxes

2. Pull and Junction Box

3. Raceways

4. Enclosures

5. Cabinets for electrical wiring

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) Publications:

1. A386: Zinc Coating (Hot Dip) on Assembled Steel Products, Specifications

B. Federal Specifications (FS):

1. W-C 586C: Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical, Cast Metal

2. W-J-800D: Junction Box, Extension, Junction Box Cover, Junction Box (Steel, Cadmium or Zinc Coated)

C. Underwriters Laboratories, Inc. (UL) Publications:

1. 50-1987: Electrical Cabinets and Boxes

2. 514-1987: Outlet Boxes and Fittings

D. National Fire Protection Association (NFPA)

E. National Electrical Code (NEC)

F. Underwriters Laboratories (UL)

G. National Electrical Contractors Association (NECA)

H. National Electrical Manufacturers Association (NEMA) Standards

I. American National Standards Institute (ANSI)

J. Society of Cable Telecommunications Engineers (SCTE)

K. International Organization for Standardization (ISO)

L. National Institute of Standards and Technology (NIST)

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquid-tight flexible metal conduit.

G. NBR: Acrylonitrile-butadiene rubber.

H. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. General:

1. All design disciplines including the architectural/engineering sub-consultants and The trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port Project Manager.

2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

3. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port and handover a model with attribute data and CAD drawings to the Port.

B. Submit manufacturer's catalog data on all NEMA boxes.

C. Submit detailed shop drawings of boxes proposed for proposed modifications to existing boxes.

D. Product Data: For surface raceways, wire ways and fittings, floor boxes, hinges-cover enclosures, and cabinets.

E. LEED Submittals:
1. Product Data for Credit IEQ 4: For solvent cements and adhesive primers, documentation including printed statement of VOC Content.

2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."

F. Samples for Initial Selection: For wire ways and surface raceways with factory-applied texture and color finishes.

1.5 QUALITY ASSURANCE

A. Electrical components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 OUTLET, JUNCTION AND PULL BOXES

A. Sheet metal boxes: Sheet metal boxes shall conform to UL 50, with a hot-dipped galvanized finish conforming to ASTM A386. Boxes and box extension rings shall be provided with knockouts. Boxes shall be formed in one piece from carbon-steel sheets. Outlet boxes shall not be less than 4-inches square and 1 1/2-inches deep. Ceiling boxes shall withstand a vertical force of 200 pounds for 5 minutes. Wall boxes shall withstand a vertical downward force of 200 pounds for 5 minutes. Gangable and through-wall types are not acceptable. Boxes shall conform to Federal Specification w-J-800D and U 514.

B. Junction boxes and Pull Boxes: Boxes shall be fabricated from carbon steel per UL 50. Boxes shall be welded construction with all seams or joints closed and reinforced. Boxes shall be galvanized after construction. Boxes intended for outdoor use shall be cast metal with threaded hubs and neoprene covers. Cover retention shall be by corrosion resistant stainless steel screws.

1. All boxes for wiring operating at 601 volts or higher shall be constructed without hinges and shall be padlock-able.

2. All boxes and cabinets shall be securely fastened to building structural members so as To prevent movement in any direction. Boxes shall not be supported by lighting fixtures, suspended ceiling support wires or freely hanging rods.

   a. Covers of boxes and cabinets mounted in horizontal plane (top or bottom) shall either weigh not more than 40 pounds or shall require not more than 40 pounds of force to open or close.

   b. Covers of boxes and cabinets mounted in vertical plane (front, back, sides) shall either weigh not more than 40 pounds or shall require not more than 60 pounds of force to open or close. All covers over 30 pounds shall be furnished with angle support at bottom to carry weight of cover for assembly.

   c. Covers of boxes and cabinets weighing more than 30 pounds shall be provided with lifting handles or some means of grasping other than edges.

3. Provide additional stiffening or reinforcing in existing pull boxes where the box shall conform to the strength requirements of the NEC and UL 50.

2.02 UNDERGROUND DUCT GENERAL REQUIREMENT

A. Cross duct below gas piping.

B. Slope duct to manholes.

C. Route duct as straight as possible between points.

D. All elbows shall be rigid PVC coated.

E. RNC: NEMA TC 2, Type EPC-40-PVC to be used in concrete encased duct bank.

F. PVC coated rigid galvanized steel to be used for direct buried in earth type of installation.

2.03 METAL CONDUIT AND TUBING

A. Available Manufacturers:

1. AFC Cable Systems, Inc.

2. Alflex Inc.

3. Allied Tube & Conduit; a Tyco International Ltd. Co.

4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.

6. Manhattan/CDT/Cole-flex.

7. Maverick Tube Corporation.

8. O-Z Gedney; a unit of General Signal.

9. Wheatland Tube Company

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel. Reduced wall or thin wall FMC shall not be used.

F. LFMC: Flexible Steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquid tight), EMT: NEMA FB 1 and UL 514B; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: Steel, set-screw or compression type.

H. Joint Compound for IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.04 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.

2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arnco Corporation.

4. CANTEX Inc.

5. CertainTeed Corp.; Pipe & Plastics Group.

6. Condux International, Inc.

7. ElecSYS, Inc.

8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.

10. Manhattan/CDT/Cole-Flex.

11. RACO; a Hubbell Company.

12. Thomas & Betts Corporation.

B. ENT: Comply with NEMA TC 13 and UL 1653.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.05 OPTICAL FIBER/COMMUNCIATIONS CABLE RACEWAY AND FITTINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arnco Corporation.

2. Endot Industries Inc.

3. IPEX Inc.

4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum installation.

2.06 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.

2. Hoffman.

3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, UL 870 and NEMA 250, Type 1 Or 3R, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold- down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.

D. Wire way Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.07 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's Standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Thomas & Betts Corporation.

b. Walker Systems, Inc.; Wiremold Company (The).

c. Wiremold Company (The); Electrical Sales Division.

2.08 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Cross-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.

3. Erickson Electrical Equipment Company.

4. Hoffman.

5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.

6. O-Z/Gedney; a unit of General Signal.

7. RACO; a Hubbell Company.

8. Robroy Industries, Inc.; Enclosure Division.

9. Scott Fetzer Co.; Adalet Division.

10. Spring City Electrical Manufacturing Company.

11. Thomas & Betts Corporation.

12. Walker Systems, Inc.; Wiremold Company (The).

13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1 and UL1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and Removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panel boards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

J. Material: To comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1

2. Corrosive Locations: NEMA 250, Type 4X

2.09 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant looking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, "ELECTRIC." or "TELPEHONE."

6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Hand holes 12 inches wide by 24 inches long and larger shall have inserts for cable Racks and pulling-in irons installed before concrete is poured.

I. Polymer-Concrete Hand holes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. CDR Systems Corporation.

d. NewBasis.

II. Fiberglass Hand holes and Boxes: Molded or fiberglass-reinforced polyester resin, with covers of polymer concrete.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Carson Industries, LLC.

b. Christy Concrete Products.

c. Nordic Fiberglass, Inc.

2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Hand hole and Pull-Box Prototype Test: Test prototypes of hand holes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying With ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Outlet Boxes:

1. Provide fixture outlets with proper fixture connectors.

2. Box mounting height shall be dictated by the wiring device enclosed.

3. Blanking covers shall be installed on all unused openings.

4. Sheet metal boxes shall be used in dry locations where the conduit system is routed concealed in the walls and ceilings.

5. Cast metal or molded non-metallic surface mounted boxes shall be used in exterior and/or in all wet locations.

6. Bonding jumpers shall be used around all concentric or eccentric knockouts.

7. Boxes shall be securely mounted to the building structure independent or conduits entering or exiting the boxes.

B. Junction Boxes and Pull Boxes:

1. Boxes shall be installed where required and where indicated on the Drawings.

2. Boxes shall be readily accessible.

3. Boxes shall not be installed in furnished areas.

4. Pull boxes shall be provided every 150 feet on long conduit runs unless the run contains three (3) or more bends, wherein spacing shall be reduced by 50 feet or less for each angle bend over three.

5. Box dimensions shall be in accordance with size and quantity of conductors and conduits entering and leaving box per NEC Article 370 requirements.

C. Miscellaneous

1. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

2. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes.

3. Install horizontal raceway runs above water and steam piping.

4. Complete raceway installation before starting conductor installation.

5. Support raceways as specified in Section 26 05 29 "Hangers and Supports for Electrical Systems".

6. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

7. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

8. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwiseindicated.

9. Raceways Embedded in Slabs:

a. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

b. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

c. Change from ENT to RNC, Type EPC-40-PVC, or IMC before rising above the floor.

10. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

11. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

12. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line With not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

13. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic And nonmetallic, rigid and flexible, as follows:

a. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.

b. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.

c. Install with a maximum of three 90-degree bends or equivalent for each length Of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

14. Expansion-Joint Fittings: Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 ºF and that has straight-run length that exceeds 25 feet. Install in each run of aboveground EMT conduit that is located where environmental temperature change may exceed 100 ºF and that has straight-run length that exceeds 100 feet. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

15. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

a. Use LFMC in damp or wet locations.

16. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

17. Set metal floor boxes level and flush with finished floor surface.

D. Raceway Application

1. Outdoors: Apply raceway products as specified below, unless otherwise indicated: Exposed Conduit: IMC or RNC, Type EPC-40 PVC.

   a. Concealed Conduit, Aboveground: IMC or EMT

   b. Underground Conduit: RNC, Type EPC-40 PVC shall be concrete encased with reinforcement.

   c. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

   d. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

   e. Application of Hand holes and Boxes for Underground Wiring:

      1) Hand holes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.

      2) Hand holes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.

      3) Hand holes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.

2. Comply with the following indoor applications, unless otherwise indicated:

   a. Exposed, Not Subject to Physical Damage: EMT.

   b. Exposed, Not Subject to Severe Physical Damage: EMT.

   c. Exposed and Subject to Severe Physical Damage: IMC. Includes raceways in the following locations:

      1) Loading dock.

      2) Mechanical rooms.

   d. Concealed in Ceilings and Interior Walls and Partitions: EMT.

   e. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

   e. Damp or Wet Locations: IMC.

g. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.

h. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.

i. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.

j. Boxes and Enclosures: NEMA 250, Type 1.

3. Minimum Raceway Size: 3/4 –inch trade size.

4. Raceway Fittings: Compatible with raceways and suitable for use and location.

a. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

b. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Installation of Underground Conduit

1. Install underground conduits specified in Section 26 05 43 "Underground Ducts And Raceways for Electrical Systems".

F. Installation of Underground Hand holes and Boxes

1. Install hand holes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent earth. undisturbed

3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

4. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and indicated. Select arm lengths to be long enough to provide spare space for future cables,but short enough to preserve adequate working clearances in the enclosure.

5. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. Fire stopping

1. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 7 Section "Fire stopping Systems."

H. Protection

1. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

   a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

   b. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 34

CONDUIT, RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provisions: Applicable provisions of Basic Electrical Materials and Methods become a part of this Section as if repeated herein.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publications:

1. C80.1-1983: Specification for Zinc Coated Rigid Steel Conduit

2. C80.1-1983: Specifications for Zinc Coated Electrical Metallic Tubing

B. Federal Specifications (FS):

1. FS W-C-1094: W-C-1094A Rigid Nonmetallic Conduit and Fittings

2. FS WW-C-563: WW-C-563A Electrical Metallic Tubing

3. FS WW-C-566: WW-C-566C Flexible Metal Conduit

C. National Electrical Manufacturers Association (NEMA) Publications:

1. RN 1-1980: Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit And Electrical Metallic Tubing

2. TC 6-1983: PVC and ABS Plastic Utilities Duct for Underground Installation

3. TC 14-1984: Filament-Wound Reinforced Thermosetting Resin Conduit

D. Underwriters Laboratories (UL) Standards:

1. 6-1981 (R1983) : Rigid Metal Electrical Conduit

2. 360-1980 (R1982): Liquid-Tight Flexible Steel Electrical Conduit

3. 651A-1981: Type EB and A Rigid PVC Conduit and HDPE (R1986) Conduit

4. 797-1983: Electrical Metallic Tubing

E. National Electrical Code (NEC)

1.03 SUBMITTALS

A. General:

1. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port Project Manager.

2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

3. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port and handover a model with attribute data and CAD drawings to the Port.

B. Catalog Date: Provide manufacturer's descriptive literature.

C. Single Submittal: A single complete submittal is required for all products covered by this Section.

1.04 LOCATIONS

A. As per General Electrical Requirements. Refer for definitions of types of locations.

PART 2 – PRODUCTS

2.01 CONDUIT, RACEWAYS

A. General: Galvanized rigid steel conduit shall be used in all conduit systems, except where otherwise shown on the Drawings, where flexible conduit is required, or where these Specifications require, or allow the use of electric metallic tubing (EMT), or duct.

1. Conduit runs for lighting and receptacles concealed in or behind walls, above ceilings, or exposed on walls and ceilings less than 5 feet above finished floors and/or subject to mechanical damage or corrosion shall be rigid steel conduit, unless noted otherwise.

2. The minimum size raceway shall be 3/4-inch.

B. Galvanized Rigid Steel Conduit (GRS) shall be hot-dip galvanized after fabrication, conforming to ANSI C80.1 and UL 6, with chromated protective layer, ETL verified to Intertek ETL SEMKO high temperature H_2O. Couplings shall be threaded type. Where PVC coated rigid steel conduit is called for, it shall be hot-dip galvanized, conforming to NEMA RN 1, with factory-applied PVC coating 40 mils thick. PVC Coating Adhesion Test Procedure for 200 hours.

C. Flexible Conduit:

1. Flexible metal conduit shall be liquid-tight, shall have low-smoke, low-flame and moisture/oil proof non-metallic insulation jacket extruded over a galvanized, flexible steel conduit, and shall conform to UL 360.

2. Flexible conduit for hazardous locations shall be UL listed for the applicable class, Division, and Group.

D. Electrical Metallic tubing (EMT) shall be galvanized thin wall conduit conforming to UL 797.

E. PVC coated RGS shall be hot-dip galvanized conforming to NEMA RN 1, with factory- applied PVC coating 40 mils thick and shall be ETL Verified PVC-001.

F. Fittings for PVC coated galvanized rigid steel conduit shall be hot-dipped galvanized steel fittings with 40 mil thick PVC coating. Manufacturer shall be Robroy Industries, Kor-Kap or approved equal.

2.02 CONDUIT SUPPORTS

A. Supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer, unless noted on drawings.

B. Supports for multiple conduits shall be hot-dip galvanized Unistrut or Superstrut channels, or approved equal. All associated hardware shall be hot-dip galvanized.

C. All channels, threaded rods, nuts and clamps in corrosive areas shall be of epoxy resin reinforced fiberglass material.

D. All channels, threaded rods, nuts and clamps in corrosive areas shall be of epoxy resin reinforced fiberglass material.

2.03 FITTINGS

A. Fittings for use with rigid steel shall be hot dipped galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse Hinds Condulets, Appleton Unilets, or equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.

B. Fittings for use with nonmetallic duct shall be PVC and have solvent-weld type conduit connections. If such are not available, then the Specification for rigid steel fittings shall apply.

C. Fittings for flexible conduit shall be Appleton Type ST, O-Z Gedney Series 4Q, or approved equal.

D. Union couplings for conduits shall be the Erickson type and shall be Appleton Type EC, O-Z Gedney 3-piece Series 4, or approved equal. Thread less couplings shall not be used.

E. Bushings:

1. Bushings shall be the insulated type.

2. Bushings for rigid steel or IMC shall be hot dip galvanized insulated grounding type, O-Z Gedney Type HBLG, Appleton Type GIB, or approved equal.

F. Conduit seals shall have zinc electroplate and shall be Crouse-Hinds Type EYS; Appleton Type EYS, ESU or EY series; or approved equal.

G. Fittings for EMT shall be all steel water tight compression type. Connectors shall be insulated throat type. Drive-on, crimp, spring or set screw fittings are not acceptable.

2.04 CONDUIT SEALANTS

A. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.

B. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL Classification 35L4.

PART 3 – EXECUTION

3.01 CONDUIT, RACEWAY AND FITTING INSTALLATION

A. From pull point to pull point, the sum of the angles of all of the bends and offsets shall not exceed 270 degrees.

B. At all boxes and equipment, provide insulated type metallic grounding bushings for metallic conduits. Bond together all conduits to provide continuity of the equipment grounding system. Size bonding conductor per NEC.

C. Provide flexible conduit in lengths of not more than 18 inches at connections to motors, valves and any equipment subject to vibration or relative movement.

D. Conduits embedded in concrete floors on grade shall be installed between grids of reinforcing steel, or shall be encased below the floors, provided the concrete is thickened in a manner satisfactory to the Engineer. Installation of conduit below the bottom of this slab is not acceptable; embedding or encasing is required.

E. Provide galvanized rigid steel factory elbows for both GRS and IMC raceways. Provide GRS for offsets in both GRS and IMC raceways.

F. Underground Raceway: Slope all underground raceways to provide drainage; for example, slope conduit from one pull box to the next pull box located down-the-line.

F. Properly support all conduits as required by NEC. Run all conduits exposed except where the Drawings, indicate that they are to be embedded in the floor slab, walls, or ceiling, or to be installed underground.

1. Exposed Conduits: Support exposed conduits within one foot of any outlet and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one- hole clamps. Coordinate conduit

locations with piping, equipment, fixtures, and with structural and architectural elements. Conduits attached to walls or columns shall be as unobtrusive as possible and shall void windows. Run all exposed conduits parallel to building lines. Group together exposed conduits in horizontal runs located away from walls and support on trapeze hangers. Arrange such conduits uniformly and neatly. Trapeze hangers shall consist of channels of adequate size, suspended by means of rods or other suitable means from the ceiling or from pipe hangers. Install such runs so as not to interfere with the operation of valves or any other equipment, and keep at least 6 incheS ends with corrosion-resistant coatings such as "Devcon Z", prepared by Subox Coatings; "Galvanox - Type 1", prepared by; Pedley-Knowles; or approved equal. Application shall follow manufacturer's recommendation.

2. Conduits Embedded in Concrete: Provide concrete cover at least equal to that of the reinforcing steel, space at 3 conduit diameters apart except where they cross at angles greater than 45 degrees, and install so as not to reduce the structural integrity of the concrete element.

H. When expansion joints are crossed, whether conduit is embedded or exposed, provide watertight expansion and deflection fittings and bonding jumpers. In hazardous locations, provide Crouse-Hinds UNF/UNV, Appleton, or equal. In unclassified locations, provide Crouse-Hinds XD, Appleton, or equal.

I. Spare Raceways: After completing a conduit or duct run between boxes, manholes or hand holes prove the integrity of the conduit run. Use an air compressor to blow in a pull-line, then use the pull-line to pull a mandrel through the entire conduit run. Install a new 1/4-inch; pnylon, 800 pound test pull-line and plug the ends of the conduit with conduit cap plugs.

J. All conduit penetrations through interior walls and floors shall be sealed with fire retardant type conduit sealant.

K. Conduit Identification: In each pull box, cabinet and motor control center, identify each conduit using the conduit number shown on the Drawings by means of a stamped brass tag. Stencil all exposed conduits for identification at least once in each room.

L. Conduit Seals:

1. Moisture Seals: Provide in accordance with NEC.

2. Gas Seals: Provide in accordance with NEC.

M. Conduit in finished areas shall be installed concealed behind the finished walls. Coordinate work as required.

N. Flexible metallic conduit shall have a maximum length of 6 feet. Flexible metallic conduit shall not be considered as a ground conductor. Flexible metallic conduit shall only be installed in exposed or accessible locations.

O. Cut EMT shall be reamed to remove all burrs.

P. All exposed conduits for medium voltage cables shall be identified "High Voltage" every 20 feet.

Q. All conduit installed exposed to weather shall be PVC coated galvanized rigid steel conduit. All connections shall be made watertight.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.03 REFERENCES

A. Comply with the latest versions of the following standards:

1. "Electrical" Article of the SFO Tenant Improvement Guide
2. American Society for Testing and Materials (ASTM)
3. National Electrical Manufacturers Association (NEMA)
4. National Electrical Code (NEC)
5. National Electrical Contractors Association (NECA) Standards

1.04 ACTION SUBMITTALS

A. General:

1. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port of San Francisco Project Manager.
2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design

coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

3. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port of San Francisco and handover a model with attribute data and CAD drawings to the Port of San Francisco.

B. Product Data: For each type of product.

C. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products 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."

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.

b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space

between sleeve and raceway or cable.

1. 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:

   a. Advance Products & Systems, Inc.

   b. CALPICO, Inc.

   c. Metraflex Company (The).

   d. Pipeline Seal and Insulator, Inc.

   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel.

4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, water stop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber water stop collar with center opening to match piping OD.

1. 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:

   a. Pre-sealed Systems.

2.04 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire- rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall have VOC content compliant with LEED requirements or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Sealant shall 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."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Nameplates, Labels, and Identification for:

a. Raceways.

b. Power and control cables.

c. Conductors.

d. Warning labels and signs.

e. Instruction signs.

f. Equipment.

g. Miscellaneous products.

2. Wire markers.

3. Conduit markers.

4. Stencils.

5. Underground Warning Tape.

6. Lockout Devices.

1.02 REFERENCES

A. Comply with American National standards Institute (ANSI) A13.1 and Z535.4.

B. Comply with National Fire Protection Association (NFPA) 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Underwriters Laboratories (UL) 969.

E. Code of Federal Regulations (CFR)

F. American Standards for Testing and Materials (ASTM)

1.03 SUBMITTALS

A. As per Submittal procedures.

B. Shop Drawings:

1. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using BIM without exception unless specifically approved in writing by the Port Project Manager.

2. Contractor shall coordinate the BIM models with each sub-consultant and subcontractor to ensure compatibility with the BIM documentation standards and for design coordination. Utilize Navisworks or similar software compatible with Revit to implement and run clash detection to identify design conflicts between the different design disciplines within the BIM models. Resolve all conflicts to the extent possible before commencement of construction.

C. Product Data:

1. Submit manufacturer's catalog literature for each product required.

2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.04 CLOSEOUT SUBMITTALS

A. Contractor shall utilize the BIM model for preparation of the Record and As-Built documents. Contractor shall convert the drawings to AutoCAD files as required by the Port and handover a model with attribute data and CAD drawings to the Port.

B. As per Contract Closeout Requirements for submittals.

C. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

D. Product Data: For each electrical identification product indicated.

E. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

F. Identification Schedule: An index of nomenclature of electrical equipment and system components and identification signs and labels.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years' experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As per requirements for transporting, handling, storing, and protecting products
.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 ENVIRONMENTAL REQUIREMENTS

A. As per requirements for environmental conditions affecting products on site.

B. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.08 EXTRA MATERIALS

A. As per Contract Closeout Requirements for extra materials.

1.09 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.01 NAMEPLATES

A. Furnish and materials in accordance with contract documents only.

B. Product Description: Laminated three-layer plastic with engraved letters.

C. Letter Size: In accordance with contract documents..

D. Minimum nameplate thickness: 1/8 inch.

2.02 LABELS

A. Labels: Embossed adhesive tape, with orange background.

B. Furnish and install materials in accordance with contract documents.

2.03 WIRE MARKERS

A. Furnish and install materials in accordance with contract documents only.

B. Description: Cloth tape or tubing type wire markers.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

2.04 CONDUIT AND RACEWAY MARKERS

A. Furnish and install materials in accordance with contract documents.

B. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

C. Color:

1. Colors for Raceways Carrying Circuits at 600 V or Less:

a. Black letters on an orange field.

D. Legend: indicate voltage.

1. Medium Voltage System: 12KV HIGH VOLTAGE.

2. 480 Volt System: 480 VOLTS.

3. 208 Volt System: 208 VOLTS.

4. 120 Volt System: 120 VOLTS

5. Telecommunication System: TELEPHONE or DATA.

6. Fire Alarm System: FIRE ALARM

7. Security Cameras: CCTV

8. Access Control: ACS

E. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

F. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.05 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length

of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.06 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather-and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.07 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.08 FLOOR MARKING TAPE

A. 2-inch – wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay

2.09 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z 535.5.

2. Inscriptions for Red-Colored Tape: ELECTRIC LINE, HIGH VOLTAGE,.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNCIATIONS CABLE, OPTICAL FIBER CABLE,.

2.10 WARNING LABEL AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.11 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.12 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.13 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 ºF, According to ASTM D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 ºF.

4. Color: Black except where used for color-coding.

B. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 ºF, According to ASTM D 638: 7000 psi.

3. UL 94 Flame Rating: 94V-0.

4. Temperature Range: Minus 50 to plus 284 ºF.

5. Color: Black

2.14 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 – EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with requirements for stencil painting.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification devices.

3.02 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment if necessary.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Replace lost nameplates, labels or markers.

3.03 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Install identifying devices after completion of painting.

C. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

D. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using screws, rivets, or adhesive.

5. Secure nameplate to inside surface of door on recessed panel board in finished locations.

6. Install nameplates for the following:

a. Switchboards.

b. Panel boards.

c. Transformers.

d. Service Disconnects.

E. Label Installation:

1. Install label parallel to equipment lines.

2. Install label for identification of individual control device stations.

3. Install labels for permanent adhesion and seal with clear lacquer.

F. Wire Marker Installation:

1. Install wire marker for each conductor at panel board gutters, pull boxes, outlet and junction boxes , and each load connection.

2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.

3. Install labels at data outlets identifying patch panel and port designation.

G. Conduit Marker Installation

1. Install conduit marker for each conduit raceway longer than 6 feet.

2. Conduit Marker Spacing: every 20 feet.

H. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. In Spaces Handling Environmental Air: Plenum rated.

J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

K. Painted Identification: Comply with requirements in painting sections for surface preparation and paint application.

3.04 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, more Than 600 V, within Buildings: Tape and stencil 4- inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to raceways concealed within wall.

3. Accessible surfaces of concrete envelope around raceways in vertical shafts,

4. Exposed in the building, or concealed above suspended ceilings.

B. Identify with self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, and hand holes, use color-coding conductor tape to identify the phase.

1. Color- Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.

2) Phase B: Orange.

3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, and hand holes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panel boards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked- enamel warning signs.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system.

L. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to be Labeled:

a. Panel boards: Typewritten directory of circuits in the location provided by panel board manufacturer. Panel board identification shall be engraved, laminated acrylic or melamine label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchboards.

e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panel boards or equipment supplied by the secondary.

f. Enclosed switches.

g. Enclosed circuit breakers.

h. Enclosed controllers.

i. Variable-speed controllers.

j. Push-button stations.

k. Contactors.

l. Remote-controlled switches, dimmer modules, and control devices.

m. Monitoring and control equipment.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provisions: Applicable provisions of Division 26 Sections – General Electrical Requirements and Basic Materials and Methods become a part of this Section as if repeated herein.

B. Work Included:

1. Installation, connection and furnishing all single, duplex, and special purpose receptacles complete with wall plates and/or covers as shown on the Drawings.

2. Installation, connection and furnishing of all single pole, three-way, pilot light and momentary position toggle switches complete with wall plates and or handle operators as shown on the Drawings.

C. Related Work Described Elsewhere:

1. Low Voltage Wire and Cable: Division 26 Section

2. Conduit, Raceway and Fittings: Division 26 Section

3. Or other work as shown in drawings.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publication:

1. C73-1973 Plugs and Receptacles

2. C73a-1980 Plugs and Receptacles

B. Federal Specifications (FS):

1. W-C596 D&E - General Specifications for Cable Outlet Electrical Connector

2. W-S-896 D&E - General Specifications for Flush Mounted Toggle and Lock Switches

3. W-P-4552 General Specifications for Surface Mounted Wall Plates

C. National Electrical Manufacturers Association (NEMA) Publications:

1. WD 1-1979 General Purpose Wiring Devices

2.	WD 3-1972	Alternating Current General-Use Snap (R1977)Switches
3.	WD 5-1977	Specific Purpose Wiring Devices

D. Underwriters Laboratories (UL) Standards:

1.	20-1986	General-Use Snap Switches
2.	498-1986	Electrical Attachment Plugs and Receptacles
3.	514-1987	Electrical Outlet Boxes
4.	943	Class A Ground Fault Receptacle Interrupting Requirements

1.03 SUBMITTALS

A. Submit manufacturers published descriptive literature properly marked to identify the items to be supplied.

B. A single complete submittal is required for all products covered by this Section.

1.04 LOCATIONS

A. Refer to Division 26 Section, GENERAL ELECTRICAL REQUIREMENTS, for definitions of types of locations.

PART 2 - PRODUCTS

2.01 RECEPTACLES

A. General: All receptacles shall be heavy duty, high abuse, ground fault interrupting conforming to NEMA configurations NEMA WD1 and UL 943 Standards.

B. Single and Duplex Receptacles:

1. Receptacles shall be of back and side wire design utilizing screw type terminals. Receptacles shall be rated 20 ampere, single-pole, 3-wire, 120 volt, NEMA 5-20 configuration, ground fault interrupting. Color shall be brown in industrial areas and ivory or white in office and laboratory areas. Power contacts shall be a T- type design and shall be brass. Ground contacts shall be brass.

2. Devices shall have a nylon composition face with a nylon or melamine body. Units shall comply with Federal Specification W-C596E and meet UL 498 test requirements. Receptacles shall be Hubbell 5352, Bryant 5362, or equal.

2.02 SWITCHES

A. Line Voltage Types: Switches shall be rated 20 amperes at 120 or 277 volts ac only. Units shall be flush-mounted, self-grounding, quiet operating toggle devices. Handle color shall be brown in industrial areas and white or ivory in office and laboratory areas. Units shall conform to Federal Specifications W-S 896 D&E, UL 20, and NEMA WDI standards.

B. Related work described elsewhere:

1. Division 26 Sections – Lighting

2. Other work as shown in electrical drawings.

2.03 PLATES

A. General: Plates shall be of the style and color to match the wiring devices, and of the required number of gangs. Plates shall conform with NEMA WDI, UL 514, ANSI C73, and FS W-P-4552. Plates on finished walls shall be non-metallic or stainless steel. Plates on unfinished walls and on fittings shall be of zinc plated steel or cast metal having rounded corners and beveled edges.

B. Non-Metallic: Plates shall be plain with beveled edges and shall be nylon or reinforced fiberglass.

C. Stainless Steel: Plates shall be .040 inches thick with beveled edges and shall be manufactured from No. 430 alloy having a brushed or satin finish.

D. Galvanized: Plates shall be galvanized sheet steel raised 1/2-inch, with rounded corners.

E. Cast Metal: Plates shall be cast or malleable iron covers with gaskets so as to be moisture resistant or weatherproof.

F. Blank Plates: Cover plates for future telephone or television outlets shall match adjacent device wall plates in appearance.

G. Outdoor Locations: Plates shall have weather protective snap covers. Covers shall be die cast aluminum for metallic plates or nylon for non-metallic plates.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. Dry Locations: The device shall be installed in surface mounted boxes with washers as required.

B. Damp or Wet Exterior Locations: Install only wiring devices approved for outdoor service in these locations.

C. Mounting Heights: Locations of wall outlets shall be measured from the finished floor to the center of the outlet box. Boxes shall be adjusted so that the front edge of the box shall not be further back from the finished wall plane than ¼-inch. Boxes shall be adjusted so that they do not project beyond the finished wall. Height above finished floor shall be as follows unless otherwise noted:

Inches From Floor	
Telephone Outlets	18
Duplex Receptacles	18
Light Switches	42

D. Damp or Wet Interior Locations: Install only wiring devices approved for outdoor service. Adjust boxes so that from edge will be no more than 1/4-inch behind the front edge of the finished wall. Use metal tubing sleeves to bring device mounting straps flush with the front edge of the finished wall.

E. Receptacles:

1. Receptacles shall be grounded by a grounding conductor, not by a yoke or screw contact.

2. Receptacles shall be oriented so that the grounding slot is located at the top of the outlet.

3. Receptacles shall be installed with connections pigtailed (spliced) to the branch circuit wiring so that removal of the receptacle will not lose neutral continuity and branch circuit power will not be lost to other receptacles on the same circuit.

3.02 INSTALLATION OF WALL PLATES

A. General: Plates shall match the style of the device and shall be plumb within 1/16-inch of the vertical or horizontal.

B. Interior Dry Locations: Install plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Do not use oversize plates or sectional plates.

C. Exterior and/or Wet Locations: Install plates with gaskets on wiring devices in such a manner as to provide a raintight weatherproof installation. Cover type shall match box type.

D. Future Locations: Install blanking cover plates on all unused outlets.

3.03 TESTS

A. Receptacles:

1. Receptacles shall be tested for blade and ground plug tension prior to installation. Do not install any receptacle having less than 16 oz. individual brace retention.

2. After installation of receptacles, circuits shall be energized and each receptacle tested for proper ground continuity, reversed polarity, and/or open neutral condition.

END OF SECTION