

CITY OF ONTARIO

ARCHITECTURAL SPECIFICATIONS (APPENDIX B)

VOLUME 4 of 8

**FOR CONSTRUCTION OF THE
ONTARIO SPORTS EMPIRE
IN THE CITY OF ONTARIO, CALIFORNIA**

~~February 17, 2025~~

~~February 28, 2025~~

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PREPARED BY:

**RJM Design Group, Inc.
31591 Camino Capistrano
San Juan Capistrano, California 92675
(949) 493-2600**

DOCUMENT 00 01 05

TABLE OF CONTENTS

DOCUMENT/SECTION No. – TITLE

VERSION DATE

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Refer to the Division 00 Procurement and Contracting Requirements specifications for the site work.

INFORMATION AVAILABLE TO CONTRACTOR

Additional information available in the Appendix

- ELECTRONIC BIDDING AND CONSTRUCTION CONTRACT DOCUMENTS TO BE PROVIDED THROUGH THE CONSTRUCTION MANAGER OR OWNERS REPRESENTATIVE.
- GEOTECHNICAL REPORTS AND AVAILABLE UPDATES (APPENDIX A)
- ARCHITECTURAL SPECIFICATIONS UNDER SEPARATE COVER (APPENDIX B)
- FOOD SERVICE EQUIPMENT SPECIFICATIONS (APPENDIX C)
- MUSCO SUPPORT DOCUMENTS (APPENDIX D)
- MUSCO STRUCTURAL CALCULATIONS (APPENDIX E)
- SITE STRUCTURAL CALCULATIONS (APPENDIX F)

DIVISION 01 – GENERAL REQUIREMENTS

Refer to the Division 01 General Requirements specifications for the site work.

DIVISION 02 – EXISTING CONDITIONS

Refer to the Division 02 Existing Conditions specifications for the site work.

DIVISION 03 – CONCRETE

03 30 00 – CAST-IN-PLACE CONCRETE

04/03/2025

03 45 00 – ARCHITECTURAL PRECAST CONCRETE

04/03/2025

DIVISION 04 – MASONRY

04 20 00 – UNIT MASONRY

04/03/2025

DIVISION 05 – METALS

05 12 00 – STRUCTURAL STEEL

01/29/2025

05 40 00 – COLD FORMED METAL FRAMING

01/29/2025

05 50 00 – METAL FABRICATION

01/29/2025

05 70 00 – DECORATIVE METALS

12/18/2024

DIVISION 06 – WOODS, PLASTICS, & COMPOSITES

06 10 00 – ROUGH CARPETRY	01/29/2025
06 20 00 – FINISH CARPENTRY	12/18/2024
06 40 00 – ARCHITECTURAL WOODWORK	01/29/2025

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 21 00 – INSULATION	04/03/2025
07 41 00 – METAL ROOF PANELS	01/29/2025
07 54 19 – THERMOPLASTIC MEMBRANE ROOFING	04/03/2025
07 60 00 – FLASHING & SHEET METAL	12/18/2024
07 62 23 – FABRICATED GUTTERS & DOWNSPOUTS	01/29/2025
07 92 00 – JOINT SEALANTS	01/29/2025

DIVISION 08 – OPENINGS

08 11 00 – METAL DOORS & FRAMES	01/29/2025
08 12 00 – METAL FRAMES	01/29/2025
08 14 00 – WOOD DOORS	01/29/2025
08 17 00 – PREFINISHED METAL DOOR OPENING ASSEMBLIES	01/29/2025
08 33 00 – COILING DOORS	12/18/2024
08 33 13 – COILING COUNTER DOORS	01/29/2025
08 71 00 – DOOR HARDWARE	04/03/2025
08 80 00 – GLAZING	01/29/2025

DIVISION 09 – FINISHES

09 24 00 – CEMENT PLASTERING	01/29/2025
09 29 00 – GYPSUM BOARD	01/29/2025
09 30 00 – TILING	01/29/2025
09 65 00 – RESILIENT FLOORING & BASE	12/18/2024
09 77 00 – FIBERGLASS REINFORCED PLASTIC PANELS	01/29/2025
09 91 13 – EXTERIOR PAINTING	12/18/2024
09 91 23 – INTERIOR PAINTING	12/18/2024
09 96 23 – GRAFFITI RESISTANT COATINGS (See Site Work Specifications)	01/29/2025
09 97 13 – STEEL COATINGS (See Site Work Specifications)	01/29/2025

DIVISION 10 – SPECIALTIES

10 21 00 – TOILET PARTITIONS	12/18/2024
10 28 00 – TOILET, BATH, & LAUNDRY ACCESSORIES	01/29/2025
10 40 00 – IDENTIFYING DEVICES	12/18/2025
10 44 00 – FIRE PROTECTION SPECIALTIES	12/18/2025

10 82 00 – LOUVERS, GRILLES & SCREENS	01/29/2025
---------------------------------------	------------

DIVISION 11 – EQUIPMENT

11 40 00 – KITCHEN EQUIPMENT (SEE APPENDIX C FOR SPECIFICATIONS)	01/29/2025
--	------------

DIVISION 14 – CONVEYING EQUIPMENT

14 24 00 – HYDRAULIC ELEVATORS	01/29/2025
--------------------------------	------------

DIVISION 21 – FIRE SUPPRESSION

21 05 17 – SLEEVES & SLEEVE SEALS FOR FIRE SUPPRESSION PIPING	12/18/2024
21 05 53 – IDENTIFICATION FOR FIRE SUPPRESSION PIPING & EQUIPMENT	12/18/2024
21 13 13 – WET-PIPE SPRINKLER SYSTEMS	12/18/2024

DIVISION 22 – PLUMBING

22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT	12/18/2024
22 05 18 – ESCUTCHEONS FOR PLUMBING PIPING	12/18/2024
22 05 19 – METERS & GAGES FOR PLUMBING PIPING	12/18/2024
22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING	12/18/2024
22 05 29 – HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT	12/18/2024
22 05 53 – IDENTIFICATION FOR PLUMBING PIPING & EQUIPMENT	12/18/2024
22 07 19 – PLUMBING PIPING INSULATION	12/18/2024
22 11 16 – DOMESTIC WATER PIPING	12/18/2024
22 11 19 – DOMESTIC WATER PIPING SPECIALTIES	12/18/2024
22 13 16 – SANITARY WASTE & VENT PIPING	12/18/2024
22 13 19 – SANITARY WASTE PIPING SPECIALTIES	12/18/2024
22 14 13 – STORM DRAINAGE PIPING	12/18/2024
22 14 23 – STORM DRAINAGE PIPING SPECIALTIES	12/18/2024
22 16 16 – CONDENSATE DRAIN PIPING	12/18/2024
22 33 00 – ELECTRIC DOMESTIC WATER HEATERS	12/18/2024
22 42 13.13 – COMMERCIAL WATER CLOSETS	12/18/2024
22 42 13.16 – COMMERCIAL URINALS	12/18/2024
22 42 16.13 – COMMERCIAL LAVATORIES	12/18/2024
22 42 16.16 – COMMERCIAL SINKS	12/18/2024
22 42 43 – COMMERCIAL SHOWERS	12/18/2024
22 47 13 – DRINKING FOUNTAINS	12/18/2024

DIVISION 23 – HEATING, VENTILATION, & AIR CONDITIONING

23 05 29 – HANGERS & SUPPORTS FOR HVAC PIPING & EQUIPMENT	12/18/2024
23 05 48 – VIBRATION & SEISMIC CONTROLS FOR HVAC	12/18/2024
23 05 53 – IDENTIFICATION FOR HVAC PIPING & EQUIPMENT	12/18/2024
23 05 93 – TESTING, ADJUSTING, & BALANCING FOR HVAC	12/18/2024
23 07 13 – DUCT INSULATION	12/18/2024
23 07 19 – HVAC PIPING INSULATION	12/18/2024
23 23 00 – REFRIGERANT PIPING	12/18/2024
23 31 13 – METAL DUCTS	12/18/2024
23 33 00 – AIR DUCT ACCESSORIES	12/18/2024
23 34 23 – HVAC POWER VENTILATORS	12/18/2024
23 37 13 – DIFFUSERS, REGISTERS, & GRILLES	12/18/2024
23 74 13 – PACKAGED OUTDOOR CENTRAL STATION AIR HANDLING UNITS	12/18/2024
23 81 26 – SPLIT SYSTEM AIR CONDITIONERS	12/18/2024

DIVISION 26 – ELECTRICAL

Refer to the Division 26 Electrical specifications included in the site work specifications.

DIVISION 27 – COMMUNICATIONS

Refer to the Division 27 Communications specifications included in the site work specifications.

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Refer to the Division 28 Electronic Safety and Security specifications included in the site work specifications.

DIVISION 31 – EARTHWORK

Refer to the Division 31 Earthwork specifications included in the site work specifications.

DIVISION 32 – EXTERIOR IMPROVEMENTS

Refer to the Division 32 Exterior Improvements specifications included in the site work specifications.

DIVISION 33 – UTILITIES

Refer to the Division 33 Utilities specifications included in the site work specifications.

APPENDICES

APPENDIX A – GEOTECHNICAL REPORT	12/18/2024
APPENDIX B – ARCHITECTURAL SPECIFICATIONS (ALL BUILDINGS)	01/29/2025
APPENDIX C – FOOD SERVICE EQUIPMENT SPECIFICATIONS	01/29/2025
APPENDIX D – RESERVED	XX/XX/XXXX
APPENDIX E – RESERVED	XX/XX/XXXX

END OF DOCUMENT

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 Scope of Work Included in this Section:

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified, and as necessary to complete the Contract, including, but not limited to, these major items:

1. Building Footings & Foundations
2. Trellis Footings & Foundations
3. Interior Floor Slabs
4. Cement Finish, Joints, Saw Cuts, & Patching
5. Setting of items to be inserted into concrete
6. Finish of concrete covered by this specification section.
7. Curing
8. Testing
9. Sealers.

1.2 Related Work Specified Elsewhere:

Testing: Section 01 41 00

Structural Steel: Section 05 12 00

Rough Carpentry: Section 06 10 00

Concrete Paving (Site Work): 32 13 13

Concrete (Site Work): Sections 03 10 00, 03 20 00, 03 30 00

1.3 General Requirements:

- A. Field Conditions.

1. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces.
2. Finish all surfaces to present a uniform appearance throughout the area involved, and throughout adjacent areas with the same treatment.
3. Where finishing occurs adjacent to finished metal or other finished surfaces, particularly where serrated or indented, remove all traces of cement film before it hardens. This applies particularly to stair nosings and similar items.

- B. Deliver and store all material in such a manner as to protect it from damage and deterioration.

- C. Design, construction, and safety of all formwork shoring and re-shoring shall be the complete responsibility of the Contractor.

- D. It shall be the responsibility of the Contractor to ensure that all applicable safety laws are strictly enforced and to maintain a safe construction project.

- E. Bundle reinforcement and tag with suitable identification to facilitate sorting and placing.

- F. Store all reinforcement to protect from rust, oil, dirt, and splash.

1.4 Quality Assurance:

- A. Testing, materials and workmanship shall conform to the requirements of the Standard Specifications and the applicable Building Code. The most stringent requirement shall apply.

- B. Material quality standards and testing procedures shall be in accordance with the American Society for Testing Materials, hereinafter referred to as "ASTM". All ASTM standards and testing procedures shall be the latest requirements.
- C. The following codes and standards apply to, and form a part of, this section, where applicable:
1. The California Building Code, latest edition.
 2. ACI 301 "Specifications for Structural Concrete for Buildings
 3. American Concrete Institute Standard "Recommended Practice for Concrete Formwork", ACI 347R.
 4. Fabrication and installation of reinforcing steel shall be in conformance with the Manual of Standard Practice for Detailing Reinforced Concrete Structures ACI 315.
 5. ACI 318 "Building Code Requirements for Reinforced Concrete"
 6. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete"
 7. American Welding Society, AWS D1.4, "Structural Welding Code – Reinforcing Steel," Latest Edition
 8. Concrete Reinforcing Steel Institute, "Manual of Standard Practice"
 9. ASTM E1155 "Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers."
- D. Tests: Refer to Section 01 41 00.
1. All tests shall be made by a testing laboratory acceptable and approved by the Structural Engineer.
 2. The cost of sampling and testing concrete required by the specifications shall be borne by the Owner.
 3. Sampling of reinforcing steel shall be done by a representative of the testing laboratory.
 4. One tensile and one bend test shall be made of each ten tons or fraction thereof for each size reinforcing steel bar #5 and larger. These tests shall be performed only if required by the Test and Inspection Request Form prepared by the Structural Engineer.
 5. Prepare and distribute copies of test reports as required by Section 1.41.
 6. Additional tests shall be made when and as directed by the Structural Engineer. Costs of test shall be borne by the Owner.
- E. One mechanical analysis and one decantation test shall be made of the sand and coarse aggregate proposed for the work. Additional tests shall be made when directed by the Structural Engineer.
- F. Concrete specimens shall be taken when directed by the Structural Engineer. At least one pair of specimens shall be taken from each pour of concrete or from each one-hundred cubic yards of concrete or major fraction thereof. One cylinder from each pair shall be tested at 7 days. One from each pair shall be tested at the age of 28 days. Concrete for specimens shall be taken from place of deposit. Specimens shall be prepared and tested in accordance with the latest ASTM specifications (ASTM C192).
- G. Prepare and distribute test reports as required by Section 01 41 00.
- H. Additional tests shall be made when and as directed by the Structural Engineer. Cost of tests shall be borne by Owner.
- I. Defective Concrete:
1. Should concrete strengths not attain the minimum specified at 28 days, the area of substandard work shall be examined by the Structural Engineer. The defective concrete shall be removed and replaced or the work shall be strengthened in a manner as directed by the Structural Engineer.

2. The cost of all examination and testing of defective material, as well as corrective measures, shall be borne by the Contractor.
3. Minor rock pockets may be chipped out and drypacked where permitted by the Structural Engineer.

1.5 Submittals:

- A. The contractor shall submit (6) copies of the concrete mix design to the architect & structural engineer for review & approval. Refer to section 01 34 00 for additional requirements. Allow a minimum of one week to review the mix design prior to ordering concrete.

PART 2 - PRODUCTS

2.1 Formwork Materials:

- A. Where finish concrete is below grade or scheduled to be plastered, plywood or sawed lumber formwork shall be constructed of substantial material as selected by the Contractor.
- B. Where finished concrete is above grade and scheduled to be exposed, use Plyform Class I and II B-B, EXT-DFPA.
- C. Form coating shall be a non-grain-raising and non-staining type that will not leave residual matter on the surface of the concrete or adversely affect bonding to concrete of paint, plaster, or other applied materials.
- D. Tie wire: Black annealed, not lighter than No. 12.
- E. General. Forms shall be constructed true to line and grade; shall conform to the shape and dimensions of the required concrete and shall be sufficiently tight to prevent the leakage of mortar and sufficiently rigid to prevent displacement or sagging between supports. Forms shall be so constructed that they can be removed without damage to the concrete. Forms for curved surfaces shall be so constructed and placed that the finished surface will not deviate from the arc of the curve, flat spots shall not be permitted.
- F. Approval of Forms and Reinforcement. Forms and metal reinforcement shall be checked and approved by the Engineering or Building Inspector before concrete is placed.

2.2 Reinforcement Materials:

- A. Reinforcing steel bars shall be of the Intermediate Grade conforming to ASTM A615, Grade 40 for size #3, and Grade 60 for sizes #4 & larger, and shall be rolled from new billets. All bars shall be identified by mil heat numbers. Refer to the reinforcing notes on the structural drawings for additional information & requirements.
- B. Steel support chairs shall be galvanized. Steel chairs making contact with exterior concrete surfaces shall have plastic coated legs so that finished concrete surfaces will not be marred or stained by rusting.
- C. Tie wire shall be 16 gage annealed wire.
- D. Welded wire fabric shall conform to ASTM A185.
- E. Refer to the General notes on sheets S-1 for additional information.

1. Fabrication:

Fabricate bars of indicated size. Accurately form to shapes and lengths indicated by methods not injurious to the materials. Do not heat reinforcement for bending. Bars with kinks or bends not scheduled will be rejected.

2. Reinforcing Steel and Wire Mesh:

Reinforcing steel shall conform to Section 201-2.2 of the Standard Specifications and shall be as stated in the structural notes on the drawings.

Wire mesh shall conform to Section 201-2.4, Standard Specifications.

2.3 Concrete Materials:

- A. All building concrete for the project shall achieve the minimum ultimate compressive strength at 28 days as stated in the concrete notes on the structural drawings.
- B. Portland Cement shall be as stated in the concrete notes on the drawings and shall conform to ASTM C150, unless Type V is specified on Engineering Drawings for reactive soils conditions.
- C. Concrete aggregate shall conform to ASTM C33. All aggregate shall be well graded and selected from a source that has a proven history of non-reactivity. Maximum aggregate size shall be one inch.
- D. Fine aggregate shall consist of washed natural sand having hard, strong and durable particles and which does not contain more than 2% by weight of clay, loam, shale, alkali, organic matter or other deleterious substances.
- E. Coarse aggregate shall consist of clean, hard, fine grained, sound crushed rock or gravel, which does not contain more than 5% by weight of flat, chip-like, thin, elongated, friable or laminated pieces. Any piece having a major dimension in excess of two and one-half (2-1/2) times the average thickness and which will adversely affect the strength of the concrete shall not be used.
- F. Moisture membrane. American Sisalkraft's "Moistop" or Visqueen (thickness per foundation plan). See paragraph 'L'.
- G. Water shall be potable clean and free from deleterious amounts of acids, alkalis, and organic materials.

1. Proportions and Mixing:

- a. The concrete shall be composed of cement, sand and coarse aggregate in the proportions as determined by the testing laboratory. Cost of mix design shall be borne by Owner.
- b. Maximum slump of concrete shall be six (6) inches. The concrete shall be mixed as directed herein:
- c. Each transit mixer shall be equipped with automatic devices for recording the number of revolutions of the drum prior to completing the mixing, with peripheral drum speed of approximately 200 feet per minute.
- d. Transit-mix concrete shall be mixed for a period of not less than ten minutes. At least three minutes of the mixing period shall be immediately prior to discharging at the job.
- e. Transit-mix concrete shall not be delivered to the work with the total specified amount of water incorporated therein. Two gallons of water per cubic yard shall be withheld, and may be incorporated in the mix, before the concrete is discharged from the mixer truck.

- f. Transit-mix concrete shall be rejected if not placed in final position within ninety (90) minutes after water is first added to the batch. The concrete, at time of placing, shall be in such condition that it can be properly placed.
 2. Proportioning shall be by weight of loose, dry material, 94 pounds of cement shall be considered one cubic foot. Fine aggregate volume shall be at least 35%, with a maximum of 50%, of the sum of the separate fine and coarse aggregate volumes. Weighing equipment shall be accurate to within one pound and be adjustable for varying aggregate moisture content. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment
 - a. Accurately control the proportions, water content, and air content.
 - b. Admixture (Other than waterproofing and integral color): If admixture is used, conform to type specified. Quantity per sack of cement and method of using admixture shall be in accordance with published recommendations of manufacturer and laboratory mix design.
 - c. Cement Grout: One part by volume Portland cement and 2-1/2 parts fine aggregate. Mix dry. Add just enough water to make mixture flow under its own weight.
 - d. Patching Mortar: Mix liquid. Combine dry mix with liquid and add water in proportions recommended by manufacturer.
- 2.4 Concrete Surface Retarder:
- A. Form Grade Concrete Surface Retarder, by L.M. Scofield Co., ChemRex, Tamms Industries, or other approved by Architect.
- 2.5 Curing and Protection Paper:
- A. Sisalkraft Orange Label or other conforming to ASTM C171, as approved by the Architect.
- 2.6 Divider Strips Embedded in Concrete Finish:
- A. One piece extruded zinc alloy strips of the type and size required by Duggan Manufacturing Co., Los Angeles, or other as approved.
- 2.7 Slip Resistant Additive:
- A. "Emerchrome" floor hardener, by L.M. Scofield Co., or approved equal.
- 2.8 Expansion Joint Sealer:
- A. For Use Except Where Sealants Specified Under Caulking and Sealants are Required:
"Igas Joint Sealer", by Sika Chemical Corp., or other approved by the Architect.
- 2.9 Curing Materials:
- A. Liquid Curing Compound: W.R. Meadows Vocomp-30 Acrylic Curing and Sealing Compound with the characteristics shown below.
 1. Color of Product: White Emulsion.
 2. Dry Film Appearance: Clear, Non-Yellowing.
 3. Weight per gallon: 8.6
 4. Water Retention: Kg/m2 @ 72 hours: 0.30
 5. Reflectance: N/A

6. Flash Point: F: >212
7. Volatile Organic Compound (VOC) g/L: 150 Other similar products, water based, acrylic curing and sealing compound shall be non-yellowing, clear, meeting the following requirements:
8. ASTM C309, Type 1, Class B
9. AASHTO M 148, Type 1, Class B
10. ASTM C1315, Class A, Section 6.4.1 – non-yellowing.

- B. Concreate Curing Membrane: Provide white opaque polyethylene or white-burlap polyethylene, in conformity with ASTM C171. Product sheet shall be non-staining reinforced type. No clear, and no “regular paper” may be used.

2.10 Concrete Admixtures

- A. General: Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in accepted mixes, unless otherwise authorized in writing by the Architect.
- B. The following admixtures may be used with written approval of Architect. Conform to manufacturers recommendations for use.
1. Water Reducing: ASTM C 494. Shall provide a minimum of 5% water reduction, 10% increase of 28 day compressive strength, drying shrinkage at 21 days shall be less than concrete without admixture.
 2. Acceleration or Retarding: ASTM C 494
 3. Air Entraining: ASTM C 260

- C. Calcium chloride not permitted.

2.11 Joint Materials

- A. Form slab edges with wood
- B. Fiber Joint Filler: ASTM D1751 non-extruding pre-molded bituminous impregnated fiberboard units. Plain or punched for dowels as required.
- C. Joint Sealants: Refer to Section 07 92 00.

2.12 Vapor Barrier/Retarder

- A. Provide vapor barrier/retarder cover over prepared base material. Use only materials which are resistant to decay when tested in accordance with ASTM E154, comply with ACI 302 for thickness, and as follows:
1. Vapor barrier/retarder: ASTM D2103, polyethylene sheeting, 10- 15 mil thickness, impact strength greater than 70 grams per mil, 10 ft. minimum width. Provide minimum 2 inch wide waterproof plastic self-adhering tape for sealing all joints, edges and ends of sheeting. Material shall be Rufco 3000B by Raven Industries, 10 15 mil Stego Wrap, Griffolyn T-105 by Reef Industries, or Nervastral Barrier by Rubber and Plastics Compound Co.
 2. Provide all accessories such as tapes, pipe, conduit, and other penetration “boots” which are to work together with vapor barrier as a system. Field fabrication of such “boots” is acceptable.
 3. Install per the recommendations in the Geotechnical Report.

2.13 Bonding, Patching, & Finishing Material

- A. Bonding Agent: W.R. Meadows Intralok, or other high solids acrylic polymer latex product meeting ASTM C1059, Type I standard.
 - B. Patching Mortar: W.R. Meadows Meadow-Patch T1 or other single-component polymer-modified cementitious thin mortar product meeting 3 hour final set in accordance with ASTM C191, and 6500 psi compressive strength after 28 days in accordance with ASTM C109.
- 2.14 Concrete Densifier and Concrete Hardener
- A. W.R. Meadows, Inc. (800) 342-5976 or equal.
 - 1. Seal Tight Liqui-Hard Concrete Densifier and Chemical Hardener Compound. VOC Content: Meets maximum VOC content of 400 g/l. for concrete protective coatings as required by US EPA Architectural Coatings Rule.
- 2.15 Concrete Degreaser
- A. W.R. Meadows, Inc. (800) 342-5976 or equal.
 - 1. Concrete Degreaser and Stripper: Seal Tight Ultrite Degreaser
 - a. Description: Biodegradable, heavy-duty, concrete degreaser and stripper.
 - b. Appearances: Clear, light yellow
 - c. pH: 10.9
 - d. Flash Point: 130 degrees F (54 degrees C)
 - e. Stability: Stable
 - f. Solubility in Water: Excellent
 - g. Rinsability with Water: Excellent
- 2.16 Mix Design
- A. Prepare design mixes for each type and strength of concrete.
 - 1. Proportions: For each material including admixtures and water, state water-cement ratio and maximum allowable water content, using not less than the minimum cement content required in paragraphs 'proportioning'.
 - 2. Materials: Manufacturer's name, designation and source of each material.
 - 3. Modified Mix: Same as other concrete types except remove 50% of the coarse aggregate.
- 2.17 Mixing Concrete
- A. Ready-Mixed Concrete: Concrete shall be supplied by an established commercial ready-mix plant conforming to ASTM C94.
 - 1. Truck Mixers: Minimum 2 cu.yd. capacity, equipped with accurate revolution counter. Operate at rated speed. Discontinue use of mixers producing unsatisfactory concrete or showing more than 10% difference in sand-cement or water-cement ratios in samples taken from front, center and back of mixer.
 - 2. Mixing Time: Total at least 15 minutes, with at least 5 minutes immediately after addition of water, and at least 10 minutes just before discharging.
 - 3. Mixing Water: Withhold 2-1/2 gallons per cubic yard from pre-determined water content. All or part thereof may be added at site, as directed.
 - B. Re-tempered Concrete: Concrete not placed within 90 minutes after water is introduced into mix or which as stood for 30 minutes after leaving mixer shall not be used.
- 2.18 Proprietary Concrete Topping
- A. Provide Elastizell lightweight concrete topping system composed of ASTM C150 cement or mortar cement, lightweight aggregate or pea gravel, ASTM C33 sand, admixtures recommended

in writing by manufacturer and reviewed by Architect, and a liquid latex bonded moisture barrier approved by Elastizell.

2.19 Concrete Sealer

- A. SikaCem 102 First Seal or approved equal. Water-based water & chemical repelling sealer. Low VOC and low odor, non-film forming, that dries clear.

PART 3 - EXECUTION

3.1 Formwork Erection:

- A. Comply with ACI 347R.
- B. All concrete above grade shall be cast-in-plywood forms.
- C. All concrete below grade shall be cast-in-plywood or sawed lumber forms.
- D. Concrete below grade may be poured directly against earth in open trenches where specifically approved by the Structural Engineer.
- E. All forms shall be constructed true to line and level, sufficiently tight to prevent leakage of mortar, and shall conform exactly to the dimensions of the finished concrete as shown on the drawings.
- F. In walls and columns over 8' high, clean out panels shall be provided at the bottom of forms to facilitate cleaning prior to pour.
- G. Where studs in formwork are spaced not over 12" o.c., 5/8" minimum plywood shall be used. Where studs are spaced not over 16" o.c., 3/4" minimum plywood shall be used.
- H. For cheek walls Contractor shall form and pour all stairs first. Cheek walls shall be formed and poured after acceptance of the step construction. Cheek walls shall be a minimum of 10" wide.
- I. Place long dimension of plywood sheets perpendicular to direction of studs.
 1. Removal of Forms:
Do not disturb or remove forms until the concrete has developed sufficient strength to safely sustain its own weight and the superimposed loads above. After concrete is placed, the following minimum time periods shall elapse before the removal of forms:

	<u>Forms</u>	<u>Shores</u>
Sides of walls and edges of slabs and footings.	3 days	5 days

3.2 Vapor Barrier/Retarder

- A. Place interior slabs on grade over vapor barrier/retarder consisting of specified vapor barrier/retarder sheet over Soils Report recommended thickness bed of washed natural sand. Turn up edges of vapor barrier/retarder 2 inches. Lap edges 6 inches. Seal all edge laps and penetrations in accordance with manufacturer's printed recommendations for solvent or heat welding. Roll sub-grade smooth prior to placing vapor barrier/retarder.
 1. After placement of vapor barrier/retarder sheet complete with penetration boots, cover with sand and compact to depth shown on drawings.
 2. Exercise care when forming curbs and other articulations to not puncture, dislodge, or otherwise damage vapor barrier/retarder.
 3. Tears, punctures and other damages to vapor barrier/retarder shall be repaired as recommended in manufacturer's published instructions. Should it become evident by Contractor, Inspector, Architect and/or CM that adequate protection of vapor barrier/retarder has not been achieved and multiple tears, punctures and other damages

have occurred, remove and replace vapor barrier/retarder at no additional cost to Owner. No addition Contract Time will be granted.

3.3 Reinforcement Placement:

- A. Coordinate all work with other trades.
- B. All bars shall be as shown on the drawings, accurately placed and wired in position by 16 gauge annealed wire. Tie stirrups to bars at both top and bottom. Bend wire ties away from forms.
- C. Maintain proper distance and clearance between parallel bars and forms. Provide metal spreaders and spacers to hold steel in position as necessary.
- D. Support steel at proper height upon approved chairs, transverse steel bars with hangers, or in other manner as necessary to accurately place and secure bars. Maintain clear spacing between parallel bars of not less than 1-1/2 times the bar diameter, but in no case less than 1-1/2". Lap and splice bars in the manner and at the locations shown on the drawings.
- E. Bars on footings or slabs on grade shall be supported on concrete blocks. Reinforcing steel in beams and suspended slabs shall be supported on steel chairs.
- F. Provide additional reinforcing bars at sleeves and openings.
- G. Before placing reinforcing and again before concrete is placed, clean reinforcement of loose mill scale, oil or other coating that might destroy or reduce bond.
- H. Refer to the reinforcing steel section of the structural general notes on sheet S-1 for information regarding rebar splicing.

3.4 Joints

- A. Provide construction, isolation, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and random cracking.
- B. Construction Joints: Construct in accordance with Drawings, ACI, and customary trade practices as approved by Architect and/or CM.

3.5 Placing of Concrete:

- A. Before the placing of any concrete, all forms shall be thoroughly cleaned and wet. Concrete shall be poured into forms immediately after it is mixed, and so that no separation will occur. No concrete which has stood for more than fifteen (15) minutes after leaving the mixer shall be used in the building. The freshly poured concrete shall be vibrated with electrically operated vibrating equipment in order to produce a concrete of maximum density. Concrete shall be rejected if not placed in final position within ninety (90) minutes after water is first added to the batch.
- B. Sandblast all surfaces on which concrete is to be placed and all construction joints, with the exception of existing concrete at the building (refer to Appendix 1 for the treatment of historic materials).
- C. Maximum free drop of concrete shall not be more than 4'-0". Use tremies in deeper sections.
- D. The location of all stoppages shall be approved by the Structural Engineer.
- F. The flow surface of the freshly poured concrete shall be level wherever any pour is stopped and tight dams shall be built as necessary to accomplish this result. Construction joints shall be made only when unavoidable, and then only at the point determined by the Structural Engineer. Details of such joints shall be as directed by the Structural Engineer.

G. Before the placing of any concrete, the surface of the previously poured concrete shall be wet.

1. Drypack:

- a. Drypack shall be composed of one (1) volume of Portland Cement and three (3) volumes of fine aggregate and only enough water shall be added to set the mixture (no free water and no slump). Drypack shall be tamped into place and thoroughly water cured.
- b. Do not use drypack that has been mixed longer than thirty (30) minutes.

2. Embedded Items:

- a. The Contractor shall cooperate with all tradesmen to ensure that all conduit, anchor bolts, sleeves, inserts, hangers, etc., are properly installed and secured in correct position. All embedded items shall be thoroughly clean and free from rust, scale, oil, or other foreign matter. All embedded items, including bolts, shall be securely held in their final positions by means of wood templates before any concrete is poured.
- b. Pipes, other than electrical conduit, shall not be embedded in structural concrete. Conduit shall be located within the middle half of the slab and its outside diameter shall not be greater than one-third (1/3) of the slab thickness.
- c. The Contractor shall properly form all reglets and rebates required in the concrete to receive flashings, frames and other equipment. Dimensions and details shall be obtained from the equipment to be provided for.

3.6 Finish of Formed Surfaces

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding ½ inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections of 1/8 inch or more completely removed and smoothed. For smooth-formed concrete surfaces that have had forms removed as early as permitted, perform the following procedures to further finish the surfaces.
 - 1. Smooth-Rubbed: No later than one day after removing forms, wet and rub surfaces to produce uniform color and texture, using the cement paste created by the rubbing process.
 - 2. Grout-Cleaned: Wet surfaces and apply a sand-cement grout that will match the color of the concrete. Fill voids, removing excess grout. When grout whitens, rub surface and keep it damp for minimum 36 hours (includes after hours, on weekends, and holidays).
 - 3. Cork-Floated: Wet surface and apply a stiff sand-cement grout that will match the color of the concrete. Machine-grind grout into voids and cork float with a swirling motion.
- C. Construction Joints: Clean and roughen the surface of all horizontal construction joints by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix.
- D. Patch tie holes with grout. Surfaces shall be made acceptable to Architect or CM.

3.7 Floating:

- A. Bring slabs to proper level, using screeds and strikeoff with a straightedge. Remove excess water and laitance. Compact by rolling with weighted rollers and by tamping with grid tampers.

Float with power rotary floating machine. Thoroughly hand-tamp areas not accessible for rolling. Float areas not accessible for power floating by hand, using a wood float. Test surface with a 10' straightedge, and eliminate high and low spots of 1/8" or more. Cumulative tolerances are not allowed.

1. Screeds.

Of such type and construction, and so spaced and located as to provide surface tolerances specified. Use continuous screeds to provide surface over which to drag straightedges. Refer to requirements under Concrete Section which apply to this work.

3.8 Metal Divider Strips:

- A. Where concrete floors finish against other materials, set combination screed and divider strip, secured in place and protected by shores until concrete on opposite side is installed. Insure that top of screed is at the exact required relationship with the top of the two finished surfaces to finish flush.

3.9 Embedded Items:

- A. Set items as exact required elevations, level and in proper relationship to other work. Where items have a drainage function, insure that slabs slope to them properly. Adjust finish work to properly connect and fit to other work.

3.10 Defective Finishing:

- A. Finish which is not true to line and plane, which is not thoroughly troweled and properly surfaced as required, which varies in excess of requirements along a 10' straightedge, which scuffs or has a rough top surface (except where required), which does not connect properly to adjoining work, which does not slope to drains, which does not match approved samples, or is not properly cured, will be deemed defective. Remove and replace with proper work and material conforming with contract requirements, and to limits directed by the Architect.

3.11 Protection:

- A. Protect all finished work from damage by impact or from building rubbish. Protect work of others from damage by this work. Protect exposed slabs and slabs which receive applied coatings from soiling from foot traffic and subsequent work performed after finishing; use protective paper cover hereinbefore specified. Maintain protection in effective condition as long as the need exists. Control the use of water within the building so that no damage to previously installed work or existing structure and finish occurs.

3.12 Markings:

- A. At expansion joints and elsewhere as indicated on the drawings, provide markings with a rounded edging or marking tool to a 1/4" radius.
- B. In textured work, edge and mark with a combination edging and smoothing tool approximately 1-1/2" wide.
- C. Where so indicated, or where required tooled markings may have been inadvertently omitted, provide markings cut into surface of cured concrete with a diamond abrasive saw. Properly coordinate this work with the work of other trades in order to avoid damage to adjacent surfaces. Unless detailed otherwise, cut sawed markings 1/8" wide by 3/4" deep.

- D. Make marking lines straight or curved where required by the drawings, equally spaced and parallel to adjacent lines or walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed.

3.13 Bases:

- A. Provide cement base where indicated. Mix: Two parts fine aggregate to one part Portland cement with a minimum amount of water to make a relatively dry mixture. Shape all work true to detail.

3.14 Curing:

- A. All concrete on grade shall be covered within 24 hours after troweling with a strong waterproof, non-staining, 2-ply kraft paper with an asphalt membrane in the center, reinforced with crossed fibers embedded in the asphalt. The paper shall be lapped 3 inches at the joints and sealed at joints and edges in an approved manner. The paper shall remain in place until removal is authorized. Heavy boards shall be provided when necessary to protect the paper and slabs from damage by other construction work.

3.15 Schedule of Finishes:

- A. The applicator of process concrete finishes must examine the substrate and the conditions under which work is to be performed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the applicator.
- B. Comply with air pollution and safety regulations of governing authorities.
- C. Protect adjacent materials and finishes from dust, dirt, and other surface or physical damage during finishing operations. Provide all protection as may be required and remove from site at completion of the work.
- D. Float finish all slab surfaces which are to receive trowel finishes and other surface or physical damage during finishing operations. Provide all protection as may be required and remove from site at completion of the work.
- E. Float finish all slab surfaces which are to receive trowel finishes and other finishes as specified and noted on drawings. After screeding and consolidating slabs, begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Hand-float in areas inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/8" in 10' when tested with a 10' straight edge. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

1. Slab Finishes:

- a. Scratch Finish: Apply scratch finish to slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
 - i. After placing slabs, plane surface to FF/SOV:45, FF/MLV:30, and FL/SOV:35, FL/MLV24 tolerances as determined by ASTM E1155. Slope surfaces uniformly to drains where required. After flattening, roughen surface before final set, with stiff brushes, brooms, or rakes.
- b. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as specified, and slab surfaces which are to be covered with membrane or other waterproofing, or roofing, and as otherwise indicated.

- i. After screening, consolidating, and flattening concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and flatten surface plane to tolerance with minimum FF/SOV:45, FF/MLV:30, and FL/SOV:35, FL/MLV24 tolerances as determined by ASTM E1155. Cut down high spots and fill low spots. Uniformly slopes surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth granular texture.
- c. Trowel Finish: Apply trowel finish to slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system, or carpeted.
 - i. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface, Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface place tolerances of FF/SOV:50, FF/MLV:36, and FL/SOV:50, FL/MLV35 as determined by ASTM #1155. Grind smooth surface defects which would telegraph through applied floor covering system.
 - ii. Carpeted areas shall receive a surface plane tolerance of FF/SOV:25, FF/MLV:17, and FL/SOV:20, FL/MLV15 as determined by ASTM E1155.
- d. Steel Trowel Finish: Provide steel trowel finish to all concrete surfaces as noted on drawings and hereinafter specified.
- e. Non-Slip Trowel Finish: Apply non-slip swirl trowel finish meeting non-slip requirements specified in Section 01 19 00. After concrete surface has been floated, and steel troweled, use a steel finishing trowel, held flat, and apply a fine textured swirl finish.
- f. Sealer (Refer to Section 09900 for additional Sealer Product Information): Apply to scheduled areas in accordance with manufacturer's published instructions.

PART IV - QUALITY CONTROL

4.1 Smoothness Tolerance:

- A. Interior and exterior cement finish surfaces shall be of such smoothness and evenness that they shall contact the entire length of a 10' straight edge laid in any direction, with an allowable tolerance of 1/8 inch. Any operations necessary to achieve this result shall be performed by the Contractor at no additional cost to the Agency.

4.2 Inspections:

- A. Inspections will be provided as necessary. Call for inspection two (2) working days prior to need.
- B. The Contractor shall call for inspection during specific phases of construction. They shall include:
 - 1. All form work prior to pouring.
 - 2. All footings prior to pouring.
 - 3. Subgrade prior to pouring.
- C. Contractor shall notify the Engineer twenty-four (24) hours prior to pouring any concrete.

- D. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.

4.3 Testing:

- A. Tests required. Compression tests of concrete shall be made as required by the Building Code except that compression tests of any grade of concrete shall be made whenever the quantity of that grade used in the project exceeds 25 cubic yards. At least two identical cylinders of each grade of concrete shall be taken of each 100 cubic yards of concrete or fraction thereof placed in the work. The cylinders shall be tested in a testing laboratory and test reports submitted to the Engineer.
- B. Storage of test cylinders on the site and after delivery to the testing shall be in accordance with A.S.T.M. Designation C31.
- C. All concrete not covered by the Building Code will be tested according to Standard Specifications.
- D. Should the strength by test fail, the mix shall be adjusted so that the resulting concrete will comply with the minimum requirements, and all additional expense resulting from such adjustment shall be borne by the Contractor. Further, should the strength of any grade by test fall below minimum, concrete from the defective pours which is in place may be tested by the core method, and if such tests show the concrete to be defective, the concrete shall be removed and replaced or adequately strengthened as required under the governing Code; and all expenses involved shall be borne by the Contractor.

END OF SECTION 03 30 00

SECTION 03 45 00
ARCHITECTURAL PRECAST CONCRETE - PLANT CAST

PART 1 - GENERAL

1.1 SUMMARY

This Section refers to architectural precast concrete units.

- A. Architectural precast concrete includes the following:
 - 1. Precast concrete units as defined in the architectural plans. Includes wall caps, trim, moldings, bases, cornices, and any other decorative element designed to be cast out of concrete.
 - 2. These are non-structural, self supporting units.

1.2 SUBMITTALS

- A. Product data and instructions for manufactured materials and products.
- B. Shop drawings prepared by CDI showing complete information concerning the precast concrete units. Indicate member dimensions and side view. Unless otherwise noted, anchors will be embedded in a standard configuration.
- C. Samples - Submit samples of color options and texture options for selection process.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. CDI has over 50 years of successful experience in fabrication of architectural precast concrete units. Fabricator has sufficient production capacity to produce, transport and deliver required units without causing delay in the project.
 - 2. Design modifications will be made only as necessary to meet field conditions and to ensure proper fitting of the work and only as acceptable to the Architect or Project Manager. Maintain general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown without architects approval. Modifications may need to be considered in view of budget constraints.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Schedules and priorities will be based on the information provided by the customer. Products to be packaged to protect the finish during transport. Precast may be a long lead time item and should be ordered accordingly.

PART 2 - PRODUCTS**2.1 REINFORCING MATERIALS**

- A. Rebar used in some product designs to insure safe handling.
- B. Corrugated Wall Ties - Included in moldings as the mechanical fastener. 22 gauge mill galvanized steel - 7/8" x 7".
- C. Threaded Inserts - Plastic inserts are **to be** included in very large castings such as large moldings, columns and stackable column components, **and in units as shown in details on the plans**. These are for mechanical ties and not for lifting purposes.
- D. Adhesives - Latex - modified mortar or equivalent used on a stable substrate in conjunction with the mechanical fastener should be used. White cement can be used to adjust the greenish color created by using the latex mortar.
- E. Premium grade construction adhesives which come in tubes should be used for bonding columns and on flat surfaces where latex mortar cannot be used.

2.2 CONCRETE MATERIALS

- A. Portland Cement: Type 1 Portland Cement Gray or Lehigh White
Use only one brand, type and source of supply of cement throughout the project, unless otherwise acceptable to Architect.
- B. Coarse/Fine Aggregate - Sand and Gravel: Hard, durable, selected and graded; free of material that causes staining or reacting with cement.
- C. Pigments: Nonfading, resistant to lime and other alkalis.
- D. Water: Drinkable, free from foreign materials in amounts harmful to concrete and embedded steel.
- E. Air-Entraining Admixture: Utilize standard mix designs incorporating admixtures which facilitate the workability, curing and strength of the mix.
- F. Compressive Strength: 3500-5000 psi minimum at 28 days.

2.3 FABRICATION

- A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and following dimensional tolerances, unless otherwise indicated.
- B. Molds: Accurately construct molds mortar-tight and of sufficient strength to withstand pressures due to concrete placing operations and temperature changes. Maintain mold work to provide completed precast concrete units of shapes, lines and dimensions indicated, within specified fabrication tolerances.
- C. Dimensional Tolerances of Finished Units: Ornamental architectural precast concrete, being tapered by design, is measured for length, width and thickness at the surface from which the mold is loaded maintaining plus or minus 1/16 of an inch tolerance. Overall height and width measured at face adjacent to mold at time of casting:
 - 1. Surface Finish: Fabricate precast units and provide exposed surface finished as follows:
 - a. **Modern — Smooth, relatively void free texture Etched finish.**
 - b. Color: **Select from CDI color chart to minimize variations in color. Gray.**

- D. Grout Joints: Grout joints between units shall be shall be tooled joints. Grout color to match precast unit color (gray).

PART 3 - RECOMMENDED EXECUTION OF THE INSTALLATION

- A. The successful installation requires experienced, knowledgeable installers in order to achieve a quality installation. Local building codes should be followed. Considerations for installation include:
1. Install precast concrete members plumb, level and in alignment. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected.
 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 3. Accessories: Install clips, hangers and other accessories required for erection of precast units to supporting members and backup materials.
 4. Anchor units in final position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges and spacers as soon as possible after anchoring and grouting are completed.
 5. Cleaning: Clean exposed facings to remove dirt and stains on units after erection and completion of joint treatments. Protect other work from damage due to cleaning operations. Do not use cleaning materials or processes that could change the character of exposed concrete finishes.

END OF SECTION 03 45 00

**SECTION 04 20 00
UNIT MASONRY****PART 1 - GENERAL****1.1 Scope:**

- A. Furnishing and installing concrete masonry units for all buildings as shown on the construction drawings. Refer to the site specifications for site work requirements
- B. Protective measures for the prevention of damage to completed masonry and other work.
- C. Removal of and disposal of surplus materials, debris, dirt, stains, etc., caused by the work, leaving the premises and all finished surfaces clean.
- D. Setting and incorporating steel reinforcing into the masonry.
- E. Setting and incorporating of steel inserts supplied by other trades.

1.2 Related Work Specified Elsewhere:

- A. Footing Concrete: Section 03 30 00 (Building).
- B. Structural Steel: Section 05 12 00.
- C. Miscellaneous Metals: Section 05 50 00.

1.3 References

- A. ANSI/ASTM A82 – Cold-Drawn Steel Wire for Concrete Reinforcement.
- B. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A924 – Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
- D. ASTM A615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- E. ASTM C90 – Hollow Load Bearing Concrete Masonry Units.
- F. ASTM C145 – Solid Load Bearing Concrete Masonry Units.
- G. IMIAC – International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.4 Submittals

- A. Submit shop drawings under provisions of Section 01 34 00.
- B. Submit shop drawings indicating bars sizes, spacings, locations, quantities of reinforcement, bending and cutting schedules, supporting and spacing devices.
- C. Submit product data under provisions of Section 01 34 00.
- D. Submit product data for masonry units and fabricated wire reinforcement.
- E. Submit manufacturer's certificate under provisions of Section 01 41 00 that products meet or exceed specified requirements.

- F. Submit manufacturer's installation instructions under provisions of Section 01 34 00.
- G. Submit shop drawings showing proposed expansion joint locations.
- H. Submit samples on site for all masonry block and precast concrete units (color, size, finish, etc.) for review/approval by architect
- I. Provide a built masonry sample/mock-up wall (for review/approval by architect) for all CMU types/colors to stay in place until all masonry construction is complete. Sample size for each shall be a minimum 4'-0" w. X 4'-0" h.
 - 1. All materials/finishes/treatments shall be showcased on the sample wall (joints, shot-blast, plaster finish, precast concrete trim pieces, graffiti coatings, etc.).

1.5 Qualifications

- A. Installer: Company specializing in performing the work of this Section with minimum five years documented experience.
- B. Installing contractor shall be current and active member of the local chapter of The Masonry Institute and provide written proof of such membership.

1.6 Environmental Requirements

- A. Masonry construction shall be in compliance with "Recommended Practices and Specifications for Cold weather Masonry Construction," latest edition, by the International Masonry Industry all Weather Council and as specified herein.
- B. Lay no concrete masonry unit when air temperature is below 40 degrees F unless materials are protected from weather and laid up in shelter. In such instances, maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during and 48 hours after completion of masonry work.
- C. In temperatures exceeding 100 degrees F, do not lay out mortar beds ahead of placing units. Use a very light fog spray, not sufficient to penetrate masonry, on vertical surface of masonry to aid in mortar curing during first 24 hours after placing units.

1.7 Quality Assurance

- A. Concrete masonry unit manufacturer shall certify in writing that masonry units furnished meet or exceed requirements of these specifications.
- B. All masonry work shall be in accordance with The Masonry Society publication TMS 602 – "Specification for Masonry Structures".
- C. All masonry work shall be in accordance with all of the requirements of Section 04 05 00 – Materials & Methods For Design of Dry Single-Wythe Concrete Masonry Wall.

1.8 Storage of Materials

- A. Deliver materials to job site in undamaged condition.
- B. Store concrete masonry units on raised platforms. Cover and protect units from inclement weather.
- C. Store mortar and grout materials in manner to prevent intrusion of moisture and contaminants.

PART 2 - PRODUCTS**2.1 Concrete Masonry Units:****A. Acceptable Product Manufacturers:**

1. Angelus Block Co., Inc.
Sun Valley Plant
11374 Tuxford St., Sun Valley, Ca. 91352/ (818)767-8576
2. Orco Block Co.,
Orange/Los Angeles
11100 Beach Blvd., Stanton, Ca. 90680/ (714) 527-2239
3. All block provided from same color/batch runs from the same manufacturing plant (provide vendor deliver receipts to insure volume of materials from same supplier and batch source).
4. Exterior Wainscots: 8x8x16 Shot-Blast CMU, Harvest (or as noted on the plans)
Exposed Exterior Walls: 8x4x16 Shot-Blast CMU, Harvest (or as noted on the plans)
Interior Walls: 8x8x16 Precision CMU, Natural Gray.
Refer to the drawings for CMU type, sizes, and colors.

B. Product Requirements:

1. Reinforcing Bars: ASTM A615, grade 60, unless otherwise shown on the drawings, using deformed bars for number 3 and larger.
2. Bending: ACI 318.
3. Wire Reinforcement: ASTM A82.

2.2 Reinforcement and Anchorage:**A. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type 1 – Moisture Controlled; medium weight. If required by Drawings or local code jurisdiction, provide precision, split-faced, scored, sandblasted (smooth), integrally colored, autoclaved, and/or UL rated units.**

1. Where block walls are to be exposed, and tops of walls are not to be covered or concealed by other materials, provide caps and other shapes to finish block wall. Caps and other shapes shall be those acceptable to Architect or Owner upon their review of submittal.

2.3 Mortar Materials**A. Provide mortar of the type specified on structural plans and color specified that conforms to ASTM C 270.**

1. All mortar shall have Dry Block integral water repellent.
2. At all exposed Exterior CMU (wainscots, pilasters, pop-outs, and other locations where CMU is exposed – see each building elevations for locations), the mortar color shall be Spec Mix #823 Medium Tan by Angeles Block Co.
3. At all other locations to receive a plaster or paint finish, a standard gray grout may be used.

B. When required, provide mortar of the type and color specified on the structural plans that conforms to ASTM C 270 except use mortar cement that conforms to ASTM C 1329.

1. Under proportion specifications, use mortar cement instead of masonry cement.
2. Under property specifications, use mortar cement instead of Portland cement lime.

3. Refer to paragraph A.3 above for grout color.

C. Mortar Mix:

1. Mortar for all walls shall be Type S only.
2. All such mortar shall contain the recommended amount of DryBlock mortar admix for water-repellency and to assure proper bond strength.

D. Mortar Mixing:

1. Make workability and consistency of mortar such that it can be worked with a trowel. Water for tempering shall be available at all times.
2. Do not permit mortar to stand one (1) hour without mixing.
3. Discard any mortar which has begun to set or is not used within 2-1/2 hours after initial mixing. Retemper mortar which has stiffened to restore its workability.
4. Mix colored mortar to produce uniform color throughout.

E. Mortar Installation:

1. All exterior block walls shall be laid with full mortar coverage on horizontal and vertical face shells, and mortar shall contain the DryBlock System integral mortar admix as per label instructions.
2. ~~All joints shall be well tooled.~~ All vertical and horizontal joints for exposed CMU at the building exterior (wainscots, pilasters, pop-outs, and other locations where CMU is exposed – see each building elevations for locations) shall be a raked joint.
3. ~~No raked joints shall be permitted.~~ For all other locations, all vertical and horizontal joints shall be well tooled.
4. Attention shall be given to NCMA TEK 53 for joint and crack control and NCMA TEK 13 and 13A and TEK 126 for proper flashing.
5. Weep holes shall be provided above all lintels and vertical obstructions per industry standards.
6. Weep holes shall be constructed with the use of a sash cord above all horizontal grout pours in the wall (including bond beams and lintels and vertical obstructions). There shall be weep holes spaced at a maximum of 32 inches o.c. between vertical grout pours. The sash cord shall be laid next to the mortar bed of the outside face shall and be exposed to the open cores of the block. For grouted cells, run sash cord or braided plastic rope through cavities before grouting, all the way to below grade drains. If needed, run cord in back of solid lintels.

2.4 Accessories

A. Control Joint Fillers:

1. Contraction Joint Material: ASTM D 2000, M1AA-805 Rubber Shear keys with a minimum durometer hardness of 80.
2. Prefabricated rubber-like material of 80 durometer hardness in conformance with ASTM D 2240. Use key of shape indicated on Drawings and of dimensions that completely fill and fit neatly, without forcing, in masonry unit jamb sash grooves and provide control joint width of 3/8" with a tolerance of 1/16". Use shear section of 5/8" minimum thickness.
3. Provide Fire Resistive Joint sealant at fire rated CMU walls; joints to be constructed in accordance with I.C.B.O. Report No. 3198 and Tremco's published instructions to obtain fire rating, for fire-rated walls noted on the Drawings.

B. Asphalt Emulsion: As follows:

1. Metal surfaces: ASTM D 1187, Type II
2. Porous Surfaces: ASTM D 1227, Type III, Class I

C. Control Joints

1. Provide Control Joint Products at Control joints where shown on the Drawings, as specifically designed for the wall width.
2. Rapid Rubber Control Joint or Rapid Poly-Joint D/A 2006/2007, by Dur-O-Wal.
3. Hohmann & Barnard #QS rubber control joint or #VS PVC control joint.

2.5 Applied Finishes

- A. Anti-Graffiti Coatings: Provide anti-graffiti coatings per specification section 09 96 23 of the site work specifications.
- B. Where CMU surfaces are to receive a paint finish provide paint products per architectural specification sections 09 91 13 & 09 91 23.
- C. Where exterior CMU is to receive a plaster finish, provide per architectural specification section 09 24 00.

PART 3 - EXECUTION

3.1 General Requirements:

- A. General Contractor/ Masonry Contractor please allow 8-10 weeks lead time from the date of a signed Angelus Block Co., Inc. purchase order for delivery of special order shot-blast CMU. Special order shot-blast CMU is to be sourced from a single Angelus location per the quantities on the signed Angelus purchase order. Angelus Block Co., Inc. should be contacted to address any CMU issues prior to installation of the product.
- B. All wall mock-ups shall be in place and approved by architect prior to start of wall construction.

3.2 Examination

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

3.3 Preparation

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Provide temporary bracing during installation of masonry work.

3.4 Coursing

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

- C. Form concave mortar joints, except where installation is to be permanently and completely covered with subsequent construction materials such as veneer plaster and waterproofing, install with flush joints
- D. Unless noted otherwise, use “running bond” method.

3.5 Placing and Bonding

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted except where curvilinear design requires such be done to yield proper curve as shown on Drawings.
- D. Remove excess mortar as Work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, un-chipped edges. Prevent broken masonry unit corners or edges.
- H. Isolate masonry from other construction with compressible joint filler.
- I. As Work progresses and prior to completion of any portion of the Work, cover the top of Work with appropriate waterproof materials to prevent infiltration of liquid water or moisture vapor.

3.6 Reinforcement and Anchorages – Reinforced Unit Masonry

- A. Install horizontal joint reinforcement. See drawings.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below opening. See Drawings.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends. Refer to Drawings.
- E. Support and secure reinforcing bars from displacement. Maintain position within ½ inch of dimensioned position.
- F. Clean reinforcement before installation. Ensure that it is clean from rust, mill scale, earth, liquid or frozen water, and other materials which might reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- G. Position reinforcement accurately at the spacing indicated or required. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.
- H. Splice reinforcement bars where shown; do not splice at other points unless accepted in writing by the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

1. Provide not less than minimum lap shown, or if not shown, as required by local governing code.

3.7 Prosecution of the Work

- A. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.
- B. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated.
- C. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters.
- D. Wet masonry unit surfaces in contact with grout just prior to grout placement.
- E. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with course grout using high or low lift grouting techniques.
- F. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout consolidation.
- G. Low Lift Grouting: Place first lift of grout to a height of 16 inches and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.

3.8 Joints

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Form control joint with a sheet building paper bond breaker, fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Size control joint in accordance with Section 07 92 00 for sealant performance.
- D. Do not exceed 24 feet between expansion and control joints. Exact location shall be shown on the shop drawings, reviewed and approved by the Architect prior to installation/application.

3.9 Built-In work

- A. As work progresses, build in materials and products shown on Drawings, and other items furnished by other Sections.
- B. Build in items plumb and level.
- C. Do not build in organic materials subject to deterioration.

3.10 Tolerances

- A. Maximum Variation From Alignment of Structural Elements: ¼ inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation From Place of Wall: ¼ inch in 10 feet and ½ inch in 20 feet or more.
- D. Maximum Variation From Plumb: ¼ inch per story non-cumulative; ½ inch in two stories or more.

- E. Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.11 Cutting and Fitting

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

3.12 Protection of Finished work

- A. Protect finish installation.
- B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

3.13 Defective Workmanship and Materials:

All work which does not conform to the requirements of the specifications shall be deemed defective and shall be removed from the site, or shall be strengthened and/or replaced as directed by the owner.

3.14 Cleaning:

At the completion of masonry work, thoroughly clean all masonry walls and leave interior and exterior surfaces of walls free from mortar and other stains. Remove all scaffolding and equipment used in the work. Clean up all debris, refuse and surplus materials and remove them from the premises.

- 3.15. Refer to the structural notes on sheet S-1 for testing requirements, **special inspection requirements**, and additional information.

END OF SECTION 04 20 00

**SECTION 05 12 00
STRUCTURAL STEEL**

PART 1 - GENERAL

1.1 Scope:

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified, and as necessary to complete the Contract, including but not limited to these major items:

1. All structural steel framing, and support members including plates and channels;
2. Furnishing of anchor bolts, base plates, expansion plates, shear stud connectors.

1.2 Related Work Specified Elsewhere:

Setting of anchor bolts. Section 03 30 00 (Building)
Miscellaneous Metal Work; Section 05 50 00

1.3 References

- A. ASTM A53 – Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- B. ASTM A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality.
- C. ASTM A123 – Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153 – Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- E. ASTM A307 – Carbon Steel Externally Threaded Standard Fasteners.
- F. ASTM A325 – High Strength Bolts for Structural Steel Joints.
- G. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- H. ASTM A501 – Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- I. ASTM A992 – Standard Specification for Steel for Structural Shapes for Use in Building Framing.
- J. AWS A2.0 – Standard Welding Symbols.
- K. AWS D1.1 – Structural Welding Code.
- L. AISC – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- M. AISC – Specification for Architectural Exposed Structural Steel.
- N. SSPC – Steel Structures Painting Council.

1.4 Submittals

- A. Submit under provisions of Section 01 34 00.
- B. Shop Drawings:

1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments and fasteners.
 2. Connections not detailed.
 3. Cambers loads.
 4. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
 5. Shop drawings shall be prepared by and submitted with the wet-signature of a professional structural engineer currently licensed in the State of the project work.
 6. Provide steel shop drawings to Architect and Structural Engineer of record for review prior to fabrication. Allow at least 2 week for shop drawing review by the architect and engineer of record.
- C. Manufacturer's Mill Certificate: Submit under provisions of Section 01 45 00 certifying that products meet or exceed specified requirements.
- D. Mill Test Reports: Submit under provisions of Section 01 45 00 Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.
- E. Welder' Certificates: Submit under provisions of Section 01 45 00 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.
- 1.5 Quality Assurance
- A. Fabricate structural steel members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. Maintain one current copy of document on site at all times.
- 1.6 Qualifications
- A. Fabricator: Company specializing in performing the work of this Section with minimum five years documented experience.
- B. Erector: Company specializing in performing the work of this Section with minimum five years documented experience.
- C. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- 1.7 Field Measurements
- A. Verify in writing that field measurements are as shown on shop drawings.
- 1.8 Testing and Inspections
- A. Independent Laboratory shall check structural steel erection for compliance with AISC Specifications including Section 8 or the "Structural Joints Using ASTM A325 or A490 Bolts", latest Edition. Coordinate erection and testing to facilitate construction.
- B. Inspection will be required of a random selection of 10 percent of all high strength shop and field bolting. To be acceptable, 95 percent of all bolts inspected shall comply with Section 8 of the AISC. If the bolting fails to meet these requirements, bolts shall be reworked and additional testing of 50 percent of all bolts shall be performed until the above requirements are met. Additional testing shall not be at Owner expense.

- C. Testing laboratory shall perform visual inspection on 10 percent of all fabricated pieces prior to shipping and on all field work (as applicable) at the site as follows:

1. Beam/Column Moment Connection Welds:.....100 Percent
2. Beam to Column/Ended Plate welds and Brace welds....100 Percent
3. Joist Girder to Column/Beam Welds.....50 Percent
4. Joist to Beam/Embedded Plate Welds:.....10 Percent
5. Edge Angle to Beam/Joist Welds.....10 Percent
6. Miscellaneous Framing Welds:.....10 Percent

To be accepted, 85 percent of all visual welds shall be inspected in accordance with AWS D1.1. If the welds fail to meet these requirements, the welds shall be reworked and additional visual inspections of 100 percent of all welds shall be made until above requirements are met. Additional testing and inspections shall not be at Owner expense.

- D. Perform ultrasonic testing in accordance with AWS D1/1 on 100 percent of all partial and full penetration welds (if applicable).

PART 2 - MATERIAL

- 2.1 Material: New tested stock of domestic manufacture complying with standard specifications hereinafter referenced. If foreign material is used, it shall meet or exceed the requirements of all authorities having jurisdiction. Refer to the structural drawings for additional information.
- 2.2 Structural Steel for Plates, Angles, & Channels: Conform to ASTM A36 unless noted otherwise on Drawings.
- 2.3 Structural Wide Flange Shapes: Conform to ASTM A572 or A992.
- 2.4 Machine Bolts: Conform to ASTM A307, Grade A and ANSI B18.2, square or hexagonal heads at Contractor's option.
- 2.5 Arc-Welding Electrodes: Conform to requirements of AWS; as required for the conditions of intended use. Use E70XX electrodes.
- 2.6 Welding Materials: AWS D1.1; type required for materials being welded.
- 2.7 Steel Tubes: Conform to ASTM A-500, Grade B.
- 2.8 Structural Pipe: Conform to ASTM A53, Grade B.
- 2.9 Anchor Bolt/Rods: ASTM F1554.
- 2.10 Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized members which occur in exterior exposed conditions, and both exposed and concealed conditions at interior locations, specifically in wet and potentially wet areas or areas of elevated moisture conditions and the connecting hallways thereto and from. Confirm locations by using RFI Form enclosed in Project Manual if there are any questions about locations requiring galvanizing.
- 2.11 Metalizing:
 - A. All steel items and fabrications shall be metalized with aluminum-zinc 85/15, at a rate of 0.010 inch coating where shown and where they may be specified to be metalized or galvanized. Typically metalize steel items and fabrications which are as follows:

1. Exterior steel building components and fabricated items which are located on the exterior ambient side of the building and in areas subject to elevated water, moisture, or humidity conditions (defined as greater than 70 percent RH on a sustained basis), as follows:
 - a. Rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.
 - b. Assembled steel products. Metalize after fabrication with work assembled in as large sections as can be handled.
 - c. Iron and steel hardware.
 - d. All ferrous metal work after fabrication.
2. All building components exposed to exterior ambient conditions.
3. All exposed interior building components located in areas subject to elevated water, moisture, or humidity conditions (greater than 70 percent RH).
4. All exposed interior building components located in areas which have concentrated chlorinated environments.

2.12 Paint for Steel Items not Metalized:

- A. Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard fast-curing, lead-free, "universal" primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS Tr-P645.
- B. Coordinate selection of metal primer with finish paint requirements specified in Section 09 91 13 & 09 91 23.
- C. Galvanizing Repair Paint: Organic zinc rich paint complying with DOD-P-ZI035 or SPCC Paint-20, with dry film containing not less than 94% zinc dust by weight.
- D. Bituminous Paint: Cold-applied asphalt mastic complying with SPCC-Paint 12 except containing no asbestos fibers.
- E. Provide a paint finish per specification section 09 91 13 & 09 91 23 on all exposed steel components and fabrications. Color per plans or match adjacent material color.

2.13 Fabrication

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- B. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free from markings, burrs, and other defects and imperfections.
- C. Connections: Weld or bolt shop connections, as indicated.
- D. Bolt field connections, except where welded or other type connections are indicated.
- E. Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.
- F. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including pulins, girts, and other framing members taking only nominal stresses) for temporary bracing to facilitate erection.

- G. High-Strength Bolted Connections: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325M-93 or A490M-93 Bolts" (RCRBSJ).
- H. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- I. Steel Wall Framing: Select members which are true and straight for fabrication of steel wall framing. Straighten as required to provide uniform, square, and true members in completed wall framing.
- J. Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches on centers, unless otherwise indicated.
- K. Holes for Other Work: Provide holes required for securing other Work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
- L. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
- M. Cut, drill, or punch holes perpendicular to metal surfaces. DO not flame cut holes or enlarge holes by burning. Bear holes in bearing plates.

2.14 Finish:

- A. Prepare structural component surfaces in accordance with SSPC SP-2.
- B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete or high strength bolted.

2.15 Test:

- A. Identified Material: If material is properly identified, mill report will be accepted.
- B. Unidentified Material: One tension and bend test for every 5 tons or fractional part thereof. Copies of all test reports shall be submitted to the Architect & structural engineer a reasonable time before starting fabrication.

2.16 Tests of Welding and Bolting:

- A. Testing agency shall inspect all shop and field welding and furnish qualified Deputy Inspectors approved by the Architect/structural engineer and registered with the Building Department under which the project is constructed. Testing and inspection shall comply with all regulations of the Building Department having jurisdiction. Testing agency shall certify in writing upon completion of the work that the welding has been performed by fully qualified welders in accordance with drawing and specification requirements and with all applicable requirements of regulatory agencies having jurisdiction.

2.17 Refer to the plans for additional notes & typical details.

PART 3 - EXECUTION

- 3.1 Painting - Ferrous Metal: Properly clean and prepare for painting in compliance with SSPC-SP3 except where more aggressive cleaning is required use SSPC-SP6/NACE 3. Apply one shop coat of material of the type specified. Thoroughly and completely cover all exposed surfaces as well as surfaces concealed after assembly. Apply primer by brush or spray gun, as best adapted to the paint material and surface conditions. Allow primer to become dry and hard before

- handling. Apply second coat primer to 1 mil minimum dry coat thickness and touch up after installation and leave in proper conditions to receive finish coats.
- 3.2 Field Measurements: Before starting work, obtain field measurements pertaining to or affecting this work, and verify the locations and exact positions of concrete and anchor bolts occurring therein.
- 3.3 Workmanship:
- A. Workmanship: Equal to the best standard practices in modern structural shops and conforming to applicable provisions contained in the AISC Code of Standard Practice, except where these requirements govern.
 - B. Injury and Excessive Stress. Transport, handle and erect structural steel in shop and field to preclude injury. In no case shall it be subject to excessive stress in any part or connection.
- 3.4 Fabrication and Assembly:
- A. Before being fabricated or worked, material shall be thoroughly wire brushed, cleaned of loose mill scale and rust, and straightened by methods that will not injure it. After punching or working the component parts of a member, remove twists or bends before the parts are assembled. Finished members shall be free from twists, bends, and open joints when erected.
 - B. Field Joining. Members and sections shall be of sizes, weights, shapes, and arrangements indicated, closely fitted, and finished true to line and in precise position necessary to allow accurate erection and proper joining of parts in the field. Drifting to enlarge unfair holes will not be allowed. Rolled sections, except for minor details, shall not be heated without prior approval.
 - C. Contact. Component parts of built-up members shall be well pinned and rigidly maintained in close contact using clamps or temporary bolting during welding. Compression joints depending upon contact bearing shall have bearing surfaces accurately milled perpendicular to their axes, or as detailed.
- 3.5 Gas Cutting: Use of a cutting torch is allowed where the metal being cut is not carrying stress during the operation, and provided stresses will not be transmitted through a flame-cut surface. Make gas cuts smooth and regular in contour. To determine the effective width of members so cut, deduct 1/8 inch from the width of the gas cut edges. Make the radius or re-entrant gas cut fillets as large as practicable, but in no case less than one inch. Grind smooth and paint.
- 3.6 Punching, Drilling and Reaming: Material may be punched 1/16 inch larger than the nominal diameter of the bolt, wherever the thickness of the metal is equal to or less than the diameter of the bolt plus 1/8 inch. Where the metal is thicker than the diameter of the bolt plus 1/8 inch, holes shall be drilled or sub-punched or reamed. The diameter for sub-punched holes and the drill for sub-drilled holes shall be 1/16 inch smaller than the nominal diameter of the bolt to be accommodated. Precisely locate finished holes to insure passage of bolts through assembled materials without drifting. Enlarge holes, where necessary, to receive bolts by reaming. Poor matching of holes is sufficient cause for rejection.
- 3.7 Welding: Welding and welded joints. Detail and execute in accordance with the requirements of the American Welding Society standards and as modified by AISC Specifications or as detailed and noted on the drawings. In the event of conflict, the notes and details on the drawings shall take precedence. Structural welding shall be done by Innershield or Submerged arc.
- 3.8 Erection:
- A. Erect structural steel by professional riggers, carefully planned and laid out so that a minimum of cutting will be necessary. Erect the work plumb, square and true to line and level, and in precise positions as indicated. Provide temporary bracing and guys wherever necessary to provide for loads and stresses to which the structure may be subjected, including those due to erection

equipment and its operation, and leave in place as long as necessary to safeguard all parts of the work.

1. Temporary Connections. As erection progresses, the work shall be securely bolted up as necessary to maintain the steel in proper position while field bolting and welding is being done, and as necessary to take care of dead loads, wind and erection stresses. No field welding or high strength bolting shall be done until the work has been properly aligned, plumbed and leveled.
 2. Sequence. Carry out the erection of structural steel in proper sequence with the work of other trades. Frame, bed, and anchor to the concrete and related work in strict accordance with the detailed drawings and approved setting diagrams.
 3. Erection Tolerance. In accordance with the latest AISC Code of Standard Practice of Steel Buildings and Bridges.
- 3.9 Anchor Bolts: Furnish to the site when and as required to maintain job progress, for installation under Concrete or Masonry Section, all anchor bolts to be embedded in the concrete or masonry for the securing of structural steel in proper position. Provide the necessary drawings and templates for the setting of such anchor bolts in the concrete forms. Be jointly responsible with others for the proper location and installation, and make good deficiencies and errors. Setting of anchor bolts in hardened concrete, necessitated through error or oversight, shall be made under direction of the Architect.
- 3.10 Grouting of Plates: Be responsible for maintaining bearing plates in proper location and in proper level while they are being grouted and be jointly responsible for a perfect job. Refer to Concrete Section for materials, mix and procedures for grouting of plates.
- 3.11 Cutting Structural Steel: Provide cuts in structural steel for mechanical, plumbing and electrical pipes as approved by Architect/structural engineer. Locate as shown on Mechanical, Plumbing and Electrical drawings. Grind smooth and paint.

END OF SECTION 05 12 00

**SECTION 05 40 00
COLD-FORMED METAL FRAMING**

PART I – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior non-load-bearing wall framing.

B. Related Requirements:

1. Section 05 50 00 "Miscellaneous Metal" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 05 12 00 "Structural Steel"
3. Section 09 29 00 "Gypsum Drywall" for cementitious backer board installation.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Interior non-load-bearing wall framing.
3. Vertical deflection clips.
4. Deflection track.
5. Post-installed anchors.
6. Power-actuated anchors.
7. Sill sealer gasket.
8. Sill sealer gasket/termite barrier.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified in accordance with ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency tested in accordance with ASTM A 370 indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide CEMCO; California Expanded Metal Products Co.; Cold-formed metal framing products or a comparable product by a current active member of the SFIA.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C955 for conditions indicated.

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.118 inch (2.99 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Slotted Track: Manufacturer's standard U-shaped steel track of web depths indicated, unpunched, with slots punched in unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches (32 mm).
- D. Vertical Deflection Clips, Interior: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AllSteel & Gypsum Products, Inc.
 - b. ClarkDietrich.
 - c. Simpson Strong-Tie Co., Inc.
- E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.118 inch (2.99 mm).
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Other accessories as required for the work

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process in accordance with ASTM A123/A123M.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or **ASTM F1941** (**ASTM F1941M**), Class Fe/Zn 5, unless otherwise indicated.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, **1/4 inch** (**6 mm**) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.7 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install in accordance with Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, in accordance with Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of **1/8 inch in 10 feet (1:960)** and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of **1/8 inch (3 mm)**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing 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. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than **1/4 inch (6 mm)** to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing in accordance with AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding **1/16 inch (1.6 mm)**.
 - D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install in accordance with Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
 - E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
 - F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
 - G. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- 3.4 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
 - B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: Maximum **16 inches on center** or as indicated on Drawings.
 - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
 - D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Connect vertical deflection clips to studs and anchor to building structure.
 3. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
 - E. Install horizontal bridging in wall studs, spaced vertically in rows not more than **48 inches (1220 mm)** apart. Fasten at each stud intersection.
 - F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.5 INSTALLATION TOLERANCES
- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of **1/8 inch in 10 feet (1:960)** and as follows:

1. Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.7 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

**SECTION 05 50 00
METAL FABRICATION**

PART 1 - GENERAL

1.1 Scope:

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified, and as necessary to complete the Contract, including, but not limited to, the following items.
- B. The extent of miscellaneous metal fabrications is shown on Drawings and includes items fabricated from iron and steel shapes, sheet goods, plates, bars, strips, tubes, pipes, and castings.
- C. Items included, but are not limited to:
 - 1. Columns and miscellaneous structural members.
 - 2. Angles and plates.
 - 3. Miscellaneous supports (concealed or exposed) for other finishes, equipment or construction.
 - 4. Shapes, sleeves, anchors, connectors, plates, backing plates, supports and fastenings required, but which are not specified in other sections.
 - 4. Woven wire panel.
 - 6. Prime coating ungalvanized steel items.
 - 7. Painting all exposed structural steel & miscellaneous metals per Section 09 91 13 (Exterior) and 09 91 23 (Interior).
 - 8. Welding.
- D. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into other construction for installation of miscellaneous metal work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

1.2 Related Work Specified Elsewhere:

Setting of items to be embedded in concrete. Sections 03 30 00 (Building)
Finish Hardware, Section 08 71 00.
Finish Painting, Section 09 91 13 & 09 91 23.
Prefabricated metal items - Pertinent sections.

1.3 General Requirements:

- A. Field Conditions. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report to the owner and architect all conditions which prevent proper execution of this work.
- B. Shop Drawings. Submit six (6) sets in accordance with Sections 01 34 00 and 05 12 00, showing in complete detail all information required for fabrication, finishing and installation of this work.
- C. Codes. Materials and work shall conform to the governing Building Code. In case of conflict between these specifications and the Building Code, the more stringent shall govern.
- D. General. Examine all drawings and specifications and include all miscellaneous metal which is specified in other sections. Provide all connections, anchors, bolts, and other fastenings as required. Do all cutting, punching, drilling and tapping required for proper assembly of the work.
- E. Delivery. Ensure that items to be set in concrete or masonry are delivered at the proper time.

- F. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.4 Work Furnished but Installed by Others:

Furnish connections and connectors necessary for the completion of the work of other sections of these specifications.

1.5 Quality Assurance:

- A. Material quality standards and testing procedures shall be in accordance with the American Society for Testing Materials, hereinafter referred to as ASTM. All ASTM standards and testing procedures shall be the latest requirements.
- B. All fabrication and erection of steel work shall be in conformance with the requirements of the American Institute of Steel Construction (AISC).
- C. All welding and built-up welded members shall conform to the requirements of the American Welding Society (AWS).
- D. Tests and Inspections: See Section 01 41 00 and 01 42 00.

- 1. Tests and Inspections shall be made by a testing laboratory approved by the Structural Engineer.
- 2. The cost of sampling and testing shall be borne by the owner.
- 3. One tension and one bend test shall be made for each size and shape of steel designated in the Test and Inspection Request Form.
- 4. Prepare and distribute test reports as required by Section 01 41 00.
- 5. Additional tests of material shall be made when, and as directed by the Structural Engineer. Cost of these tests shall be borne by the owner.
- 6. Inspection of welding designated on the Test and Inspection Request Form shall be made by an Inspector approved by the Structural Engineer who shall certify that the welding is in compliance with these drawings and specifications. The Contractor shall provide access to the work for inspection purposes, and shall notify the Inspector when work is to be performed. The cost of this inspection shall be borne by owner.

1.6 Submittals:

Submit six sets of shop drawings of work specified herein and as shown on drawings & details. Fabrication and/or erection prior to receipt of Structural Engineer's approval is at Contractor's sole risk. All shop and fabrication drawings shall be referenced to the applicable sections or details on the Contract Drawings. Shop drawings not so referenced will be rejected.

1.7 Warranty

- A. All fabrications and assemblies under this section of specifications shall be warranted for two (2) years from date of Owner acceptance from defects in materials, products and workmanship – shop and field labor.
 - 1. At the option of the Owner, repair or remove and replace all such defective materials and products at no additional cost to Owner during the warranty period, and at the convenience of the Owner. There shall be no prorations.

1.8 Refer to all construction drawings, including notes on the architectural plans and details.

PART 2 - MATERIALS

2.1 Materials and Components

- A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
 - 1. Wherever metal is to be corrosion-resistant and is to be in contact with treated wood, metal shall be stainless steel or steel shall be G185 finish in conformity with E2-94 of the American Wood Preserver' Association. This standard shall take precedence to other finishes as specified hereafter.
- B. Malleable Iron Casting; Conform to ASTM A47.
- C. Welding Rods: Conform to requirements of AWS for intended use & ASTM E70XX.
- D. Steel Plates, Shapes and Bars: ASTM A 36 and A992.
- E. Steel Tubing: Hot-formed, seamless, ASTM A 501 or cold-formed, ASTM A 500.
- F. Structural Steel Sheet: Hot-rolled, ASTM A 570; or cold-rolled ASTM A611, Class 1; of grade required for design loading.
- G. Galvanized Structural Steel Sheet: ASTM A 446, of grade required for design loading.
- H. Steel Pipe: ASTM A 53; Type S; Grade B; black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise shown or specified.
- I. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- J. Concrete Inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47 or cast steel ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.
- K. Fasteners: provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
 - 1. Bolts and Nuts: Regular hexagon head type, ASTM A 325.
 - 2. Lag Bolts: Square head type, FS FF-B-561.
 - 3. Machine Screws: Cadmium plated steel, FS FOF-S-92.
 - 4. Wood Screws: Flat head carbon steel, FS FF-S-1 I .
 - 5. Plain Washers: Round, carbon steel, FS FF-W-92.
 - 6. Lock Washers: Helical spring type carbon steel, FS FF-W-84.
 - 7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.
- L. Non-Metallic, Non-Shrink Grout: CE-CRD-C621, factory pre-mixed grout. Provide one of the following:
 - 1. Masterflow 713; Chemrex, Inc.
 - 2. Five Star Grout; U.S. Group Corp.
 - 3. Upeon; Upeo Chem. Div., USM Corp.
- M. Proprietary Support Framing System for Other Finishes, Equipment or Construction System: Provide Unistrut Metal Framing products.
 - 1. For exposed use in wet, potentially wet, or elevated moisture conditions: Provide Type 304 Stainless Steel.
 - 2. For permanently concealed use in wet, potentially wet, or elevated moisture conditions: Provide Type 316 Stainless Steel.
 - 3. For all other conditions, concealed or exposed: Provide hot-dipped galvanized.

N. Paint:

1. Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard, fast-curing, lead-free, "universal" primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS Tr-P-645.
2. Coordinate selection of metal primer with finish paint requirements specified in Division 9.
3. Galvanizing Repair Paint: Organic zinc rich paint complying with DOD-P-ZI035 or SPCC Paint-20, with dry film containing not less than 94% zinc dust by weight.
4. Bituminous Paint: Cold-applied asphalt mastic complying with SPCC-Paint 12 except containing no asbestos fibers.
5. Provide a paint finish on all metal per specification section 09 91 13 and 09 91 23, color as noted on plans or match adjacent material color.

2.2 Fabrication

- A. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
- B. Use hot-rolled steel bars for work fabricated from bar stock, unless shown or specified to be fabricated for cold-finished or cold-rolled stock.
- C. Supply as part of this Section, miscellaneous small parts of material thinner than 10 gage, or items specifically called out in this section, when such supply is a normal and accepted part of the work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head countersunk screws or bolts.
- G. Provide type of anchorage shown. Coordinate with supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support for intended use.
- H. Cut, reinforce, drill and tap miscellaneous metal work as required to receive finish hardware and similar items.
- I. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
- J. Galvanizing: All steel items and fabrications (including trellis/shade fabrication) shall be galvanized and where items of Work may be specified to be galvanized. Typically galvanize steel items and fabrications which are as follows:
 1. Exterior steel lintels supporting masonry, and all other building components and fabricated items which are located on the exterior ambient side of the building and in areas subject to elevated water, moisture, or humidity conditions (defined as greater than 70 percent RH on a sustained basis), as follows:
 - a. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.

- b. ASTM A 386 for galvanizing assembled steel products. Do galvanizing after fabrication with work assembled in as large sections as can be handled.
 - c. ASTM A 153 for galvanizing iron and steel hardware.
 - d. Hot dip galvanize all ferrous metal work after fabrication.
 - 2. All building components exposed to exterior ambient conditions.
 - 3. All exterior to-be-concealed building components receiving subsequent finishing or other construction.
 - 4. Wherever metal is to be corrosion-resistant and is to be in contact with treated wood, metal shall be stainless steel or steel shall be G185 finish in conformity with E12-94 of the American Wood Preservers' Association.
 - 5. Use galvanizing repair paint acceptable to Architect following assembly of parts requiring field welding of components and parts.
- K. Shop Painting: Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.
- 1. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SPCC SP-2 "Hand Tool Cleaning", or SPCC SP-3 "Power Tool Cleaning" or SPCC SP-7 "Brush-Off Blast Cleaning".
 - 2. Remove oil, grease and similar contaminants in accordance with SPCC SP-1 "Solvent Cleaning".
 - 3. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at a rate to provide uniform dry film thickness of 1.0 mils for each coat. Use painting methods which will result in full coverage of joints, comers, edges and exposed surfaces.
 - 4. Apply one shop coat to fabricated metal items, except apply 2 coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

2.3 Miscellaneous Metal Fabrications

- A. Manufacture or fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.
- B. Hot dip galvanize all exterior metal work after fabrication unless otherwise indicated. All projections, barbs, and icicles shall be removed after galvanizing.
- C. Rough Hardware: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork and countertops, and for anchoring or securing woodwork and countertops to concrete or other structures. Furnish fabricated steel (ASTM A 36) shapes, plates and bars, welded into assemblies of types and sizes indicated. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
 - 1. Finish fabricated assemblies intended for exterior or potentially elevated moisture or water-use, with hot-dip zinc coating (ASTM A153), including bolts and other fasteners.
- D. Miscellaneous Framing and Supports: Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.
 - 1. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
 - 2. Equip units with integrally welded anchor straps for casting into poured concrete or building into masonry wherever required. Furnish inserts if units must be installed after

concrete is placed. Except as otherwise shown, place anchors 24 inches o.c. and provide minimum anchor units of 1-1/4 x 1/4 x 8 inch steel straps.

- E. Miscellaneous Steel Trim, Provide shapes and sizes as required for profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation of other work. Galvanize miscellaneous steel trim where indicated.

2.4 Items Embedded in Concrete:

Provide bolts, eyebolts, dowels, anchors, plates, inserts, and other miscellaneous items that are to be installed in forms before concrete pouring, or for building into masonry, as indicated. Examine and check the drawings for the number type and location of such items.

2.5 Installation:

Install all items plumb, level and square, securely and rigidly attached to supporting construction and as detailed.

2.6 Description of Items:

Those items which are standard or stock design which are sufficiently detailed or described on the drawings to permit their fabrication and installation are not covered herein even though they may be included in the scope.

2.7 Welding:

All welding shall conform to requirements of the Committee for Standard Tests for Welds of the American Welding Society. All welding shall be electric arc process. Welds exposed in finish work shall be filled out flush, ground and dressed. Welders for structural shall be certified.

2.8 Inspection of Welding:

Inspection of all welding shall be done under the direct supervision of an approved and licensed welding inspector. Steel fabricator shall notify the welding inspector prior to and shall not commence any welding without the welding inspector present. The owner shall be furnished a report by the welding inspector verifying that the welds conform to the drawings and specifications. (See Inspector of Work - Section 01 42 00.)

PART 3 - EXECUTION

3.1 Preparation:

- A. Coordinate anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 Installation:

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screw and other connectors as required.
- B. Cutting and Fitting: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of

shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been not-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

- C. Placement: Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.
- F. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- G. Repair of Galvanized Surfaces: Repair areas damaged by welding, cutting or during handling, transport or erection in accordance with ASTM A 780 by application of multiple coats of galvanizing repair paint, to dry film thickness of 8 mils.

END OF SECTION 05 50 00

**SECTION 05 70 00
DECORATIVE METAL**

PART - 1 GENERAL

1.1 Description:

A. Section Includes:

1. Steel and aluminum, materials for miscellaneous metal fabrications specified in this section and required but not specified in other sections.
2. Anchors and fasteners for connection to concrete, masonry and steel construction.
3. Characteristics, including fabrication and finish requirements for metal fabrications not otherwise specified in other sections.
4. Galvanizing of steel products.
5. Shop priming and painting of steel fabrications.
6. Miscellaneous metal fabrications, such as:
 - a. Steel ventilation screen.
 - b. Rough hardware.

B. Related Sections:

1. Section 03 30 00 (Building) – Concrete Reinforcing: Placement of embedded products.
2. Section 03 30 00 Building) – Cast-in-Place Concrete: Materials and methods for grouting of structural members.
3. Section 06 10 00 – Rough Carpentry: Metal framing anchors.
4. Section 09 91 13 & 09 91 23 – Painting and Coating: Field priming; field-applied finish on interior metal fabrications.

1.2 References:

A. The California Building Code, latest edition.

B. Aluminum Association (AA):

1. AA - Standards for Architectural Aluminum.
2. AA - Designation System for Aluminum Finishes.

C. American Hot Dip Galvanizers Association (AHDGA): Recommended Details for Galvanized Structures.

D. American Institute of Steel Construction (AISC):

1. AISC Manual of Steel Construction.
2. AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

- E. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code--Steel.
 - 2. AWS D1.2 - Structural Welding Code--Aluminum.
 - 3. AWS D1.3 - Structural Welding Code--Sheet Steel.
- F. National Association of Architectural Metals Manufacturers (NAAMM): Metal Finishes Manual.
- G. Steel Structures Painting Council (SSPC): SSPC Painting Manual, Volumes 1 and 2.

1.3 Submittals:

- A. Product Data: Submit catalog data for all standard production products.
- B. Shop drawings:
 - 1. Indicate fabrication and installation of metal fabrications.
 - 2. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 3. Include erection drawings, elevations, and details where applicable.
 - 4. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
 - 5. For products indicated to comply with certain design loadings, include structural analysis data sealed and signed by a Professional Structural Engineer registered to practice in the State of California, who was responsible for their preparation.
- C. Product Data: Submit catalog data for all standard production products.
- D. Coating Submittals:
 - 1. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
 - 2. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
 - 3. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
 - 4. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - a. Project name and location.
 - b. Name of owner.
 - c. Name of contractor.
 - d. Name of architect.
 - e. Name of coating manufacturer.
 - f. Approximate area of coatings applied.
 - g. Date of completion.
 - 5. Warranty: Submit manufacturer's standard warranty.

1.4 Quality Assurance:

- A. Regulatory Requirements: Conform to Uniform Building Code (UBC), Chapter 22.
- B. Fabricator's Qualifications: Fabricator of light structural steel framing members and other miscellaneous metal fabrications of structural character shall be approved by the Building Official in accordance with applicable code provisions.
- C. Welder's Qualifications: Welding shall be performed by certified welders qualified in accordance with procedures specified in applicable referenced AWS standard, using materials, procedures and equipment of the type required for the Work. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- D. Coordination: Provide templates and sleeves for incorporation of embedded items into the work specified elsewhere herein.
- E. Coordination: Provide templates and sleeves for incorporation of embedded items into the Work specified in other sections.
- F. Field-Verified Dimensions: Prior to fabrication, field verify dimensions and details of construction. Immediately report variances in writing to Engineer.

1.5 Delivery, Storage and Handling:

- A. Storage, General: Store products in enclosed, well-ventilated spaces, not in contact with soil or vegetation and not subject to inclement weather.
- B. Delivery, Storage and Handling, Galvanized Products:
 - 1. Stack and bundle during transport and store to allow air flow between galvanized surfaces.
 - 2. Load for transport to permit continuous drainage should wetting occur.
 - 3. Do not rest galvanized products on cinders or clinkers.

1.6 Project Conditions:

- A. Field Inspection of Fabricated Products: Prior to installation, inspect products for damage and verify markings and dimensions against reviewed submittals.
- B. Environmental Conditions: Do not install products intended for interior locations when spaces are uncovered and unprotected from inclement weather.
- C. Coordination: Coordinate metal fabrications Work with Work specified in other sections so that related Work shall be accurately and properly joined.

PART - 2 PRODUCTS

2.1 Ferrous Metals:

- A. Ferrous Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide ferrous metals materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Steel Shapes: Steel plates, bars, angles, channels, and H-sections: ASTM A36.
- C. Steel Tube:
 - 1. Hot-rolled: ASTM A501.
 - 2. Cold-formed: ASTM A500.
- D. Steel Pipe: ASTM A53 (black steel and hot-dip galvanized).
- E. Steel Sheet:
 - 1. For structural uses: Hot-rolled, ASTM A570; cold-rolled, ASTM A611.
 - 2. For nonstructural uses: Cold-rolled, ASTM A366; hot-rolled, ASTM A569.
- F. Steel for Galvanized Products:
 - 1. Structural shapes, plates and bars: From fully killed or semi-killed steel, ASTM A36 or A572, except silicon content in the range 0 to 0.4 percent or 0.15 to 0.25 percent, as applicable, only.
 - 2. Steel fasteners: ASTM 307, Grade A or B for bolts; ASTM A563, Grade A for nuts.
 - 3. Sheet steel: ASTM A526, with ASTM A525, Coating Designation G90, for precoated sheet; ASTM A569 or A570 for sheet used in fabrications.
 - 4. Steel for pipe and tubing: ASTM A53, A120 or A595 Grade A or B.
 - 5. Galvanizing: See requirements specified below.

2.2 Hardware and Industrial Cloth:

- A. Hardware and Industrial Cloth (Wire Mesh): McNichols TECHNA 3150 galvanized steel designer wire mesh, as produced by McNichols Co., Tampa, FL or approved equal.
- B. The entire vent screen assembly, including the wire mesh shall be painted per Section 09 91 23, Interior Paint, color per plan.

2.3 Anchors, Fasteners and Accessory Materials:

- A. Anchors and Fasteners, General: Same material, color and finish as the metal to which applied, unless otherwise indicated.
- B. Exterior Exposure: Provide stainless steel.

- C. Type, Size and Spacing: Unless otherwise indicated, provide fasteners of type, grade and class required for intended use and sized and spaced as required for loads and substrate.
- D. Screw Head, Typical: Unless otherwise noted, exposed screws shall be phillips oval or flat head, countersunk.
- E. Standard Bolts and Nuts, Steel: ASTM A307, Grade A, hexagonal head.
- F. Lag Screws and Bolts, Steel: ANSI B18.2.1, type and grade best suited for the purpose, hexagonal or square head.
- G. Plain Steel Screws: FS FF-S-85, FS FF-S-92 and FS FF-S-111; type and grade best suited for the purpose.
- H. Stainless Steel Screws: AISI 300 Series.
- I. Self-Drilling Metal Fasteners: TEKS by Buildex Division, Illinois Tool works, Inc.
- J. Plain Steel Washers: FS FF-W-92, round, carbon steel.
- K. Lock Washers: FS FF-W-84, helical spring, carbon steel.
- L. Toggle Bolts: FS FF-W-588, type, class and style as required for substrate.
- M. Concrete and Masonry Anchors, Wedge-Type: As indicated on the Plans or, if not indicated, Kwik-Bolt or Red Head, or approved equal; provide type and size as indicated or, if not indicated, as directed by Engineer.
- N. Concrete and Masonry Anchors, Self-Threading: TAPCON, as manufactured by Buildex Division, Illinois Tool Works, Inc., or approved equal.
- O. Fiber Plugs and Screws: Not permitted.
- P. Lead Expansion Shields: Not Permitted.
- Q. Power-Driven Fasteners: Use only if approved by Engineer, generally not permitted where not specifically indicated or in load-bearing installations; Fed Spec FF-P-395 or Fed Spec GGG-D-777; Hilti, RamSet or approved equal.
- R. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.4 Paints and Coatings:

A. Shop Primer Paint:

1. Shop primer, general: Coordinate primer with finish paint and coating, as applicable, to provide sound foundation for field-applied topcoats despite prolonged exposure during construction.
2. Shop primer for exposed exterior & interior locations: As specified in Sections 05 12 00 & 05 50 00

B. Field Primer and Finish Paints: As specified in Section 09 91 13 & 09 91 23 – Exterior & Interior Painting.

2.5 Grouting Compounds:

A. Metallic Shrinkage-Resistant Grout: For filling under equipment and interior miscellaneous metal fabrications; pre-mixed factory-packaged compound, metallic aggregate, minimum 7000 psi 28-day compressive strength. Confirm product selection with manufacturer's recommendations for intended use.

1. Firmix by Euclid Chemical Co., Cleveland, OH
2. Embeco 636 or Embeco 885 by Master Builders Technology, Inc., Cleveland, OH.
3. Kemox G by Sika Corporation, Lyndhurst, NJ
4. Ferrolith G by Sonneborn Building Products, Division of ChemRex, Inc., Minneapolis, MN.
5. Or approved equal.

B. Non-Metallic Shrinkage-Resistant Grout: For filling around anchors for exterior miscellaneous metal fabrications; pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621, minimum 7000 psi 28-day compressive strength.

1. Euco N.S. by Euclid Chemical Co., Cleveland, OH
2. Masterflow 713 or Masterflow 928 by Master Builders Technology, Inc., Cleveland, OH.
3. Or approved equal.

C. Shrinkage-Resistant Setting Grout: For setting railing posts and similar components in sleeves or blockouts in concrete; pre-mixed, natural aggregate, minimum 7000 psi 28-day compressive strength, Set Grout, as manufactured by Master Builders Technology, Inc., Cleveland, OH, or approved equal.

D. Non-Shrink Polymer (Epoxy) Grout: For setting anchor bolts in concrete.

1. For anchor bolts for structural members: As noted on Plans.

2. For anchor bolts for non-structural components: Polymer (epoxy) grout, Brutem MP or AB, as recommended by manufacturer for intended use, as manufactured by Master Builders Technology, Inc., Cleveland, OH, or approved equal.

2.6 Metal Fabrications, General:

- A. Metal Fabrications, General: Provide metal fabrications of shapes and sizes indicated for profiles shown.
 1. Where specific sizes are not indicated, provide materials of sufficient size, thickness and type to provide necessary strength and durability.
 2. Thickness of metal, details of metal, details of assembly and support shall give ample strength and stiffness for the intended purpose.
 3. Provide brackets, flanges and anchors of cast or formed metal of the same type material and finish fabricated product, unless otherwise indicated.
 4. For exterior fabrications, allow for thermal movement in the design, fabrication, and installation of metal fabrications, to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Accommodate temperature range of 100 degrees F.
- B. Preparation Before Fabrication: Remove loose mill scale and rust and remove twists and bends in manners not injurious to materials and finishes.
- C. Fabrication: Fabricate and finish metal items in accordance with the Plans and reviewed shop drawings.
 1. Contractor shall verify measurements before fabrication.
 2. Sandblast and metalize steel items as indicated on plans.
 3. Fabricate and shop-assemble in largest practical sections for delivery to site.
 4. Prepare and reinforce fabrications as required to receive applied items.
- D. Cutting and Fitting: Fabricate with accurate angles and surfaces, true to the required lines and levels and as required to suit installation conditions.
 1. Fabricate items with joints tightly fitted and secured.
 2. Make exposed joints tight, flush, and hairline.
 3. Punch, drill and reaming in manner to leave clean, true lines and surfaces.
 - a. Oversize hole 1/16-inch by punching, when material thickness is equal to or less than bolt diameter plus 1/8-inch.
 - b. Sub-punch 1/16-inch smaller than bolt and drill or ream to oversize by 1/16-inch, when material thickness is thicker than bolt diameter plus 1/8-inch.
 4. Gas cutting of steel will be acceptable where stress will not be transmitted through flame-cut surfaces.
 - a. Make cuts clean and to contour.
 - b. Deduct 1/8-inch from effective width of members cut by torch.
 5. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

6. Provide cutouts, fittings, and anchorage provisions as required for coordination of assembly and installation with other Work.
- E. Edges: Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work. Remove sharp or rough areas on exposed traffic surfaces.
- F. Welding: Weld corners and seams continuously to comply with AWS recommendations and the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- G. Coordination: Make provisions to connect metal fabrications with or to receive work specified in other sections.
- H. Connections, General: Component parts of built-up members shall be well-pinned with closely-fitted contact. Conceal connections where possible. Otherwise, make countersinks for concealment after fabrication, except where noted.
- I. Joints, General: Fit or miter to hairline tolerances. Provide lugs, clips, anchors and miscellaneous fastenings necessary for complete assembly and installation. Component parts of built-up members shall be well-pinned with closely fitted contact.
 1. Joints on finished surfaces: Provide welds ground smooth and filled.
 2. Joints exposed to weather or water: Form joints to exclude water or provide weep holes where water may accumulate.
 3. Sheet metal joints: Hem exposed edges.
 4. Bolted and Screwed Connections: Provide holes and connections for Work specified in other sections. Use bolts for field connections only. Provide washers under heads and nuts bearing on wood. Draw all nuts tight and nick threads of permanent connections. Use beveled washers where bearing is on sloped surfaces. Where screws must be used for permanent connections in ferrous metal, use flat head type, countersunk, with screw slots filled and finished smooth and flush.
- J. Embedded Fabrications: For embedment in concrete, provide weld-on lugs or anchors as detailed or required.
- K. Brazing: Brazing shall be of adequate strength and durability with joints tight and flush, smooth and clean. All exposed surfaces shall be ground and finished flush, free of brazing discoloration and other marks. Brazing on finished surfaces shall be indistinguishable from parent metal.

- L. Welding: Conform to AWS D1.1. Do not field weld galvanized components to remain unfinished. Grind welds smooth and flush with base material. Re-weld to fill holes. Putties and fillers will not be accepted.

- M. Light Structural Steel Framing Fabrications: Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges.
 - 1. General: Design of fabrications shall be by licensed Professional Engineer, registered in the State of California. Fabricate structural steel members in accordance with AISC Specifications and the California Building Code (CBC), Chapter 22.
 - 2. Shop Connections: Make welded connections in accordance with AWS D1.1.
 - 3. Welding shall be done in the shop unless otherwise indicated.
 - 4. All shop welding shall be continuously inspected.
 - 5. Field Connections: Provide bolted connections, except where welded connections are indicated.
 - 6. Column Bases: Provide base plates shop welded to columns.
 - 7. Weld Finishing: Grind and dress smooth all welds exposed in finished Work to preserve shape and profile of welded item.
 - 8. Shop Painting: Shop prime all structural steel, except steel to be encased in concrete or to be fireproofed. Apply one-coat shop primer paint system in accordance with SSPC Paint System PS 7.01.

- N. Steel Tubing and Piping Fabrications: Close ends with plate stock, no exposed ends; grind edges.

- O. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Clearly mark units for reassembly and coordinated installation.

2.9 Metalized Finish

- A. Fabrication: Miscellaneous metal work which will be exposed to view shall only be fabricated with materials that are smooth and free of surface blemishes, including pitting, seam marks, trade names and roughness. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating, or applying surface finishes.

- B. Shop Assembly: Work shall be fitted, shop assembled, and ready for erection whenever possible.

- C. Workmanship: Form metals to shape and size with sharp lines and angles, and with smooth surfaces and faces free from distortion. Mill fastening to a close fit. Do all fitting true to line. Bend or form all tubing, pipe, and other members to continuous and true curves with all joints flush and neatly fastened together. All fabrications shall be square, plumb, straight, and true.

- D. Jointing and Connections: Jointing and intersections shall be accurately made in true planes and tightly fitted to hairline joints. Connections shall be welded. Do not use screws unless

specifically shown or required - if used, screws shall be countersunk with a metal compatible with the members being joined.

- E. Welding: Welding shall conform to the requirements of the "Structural Welding Code" ASW D1.1. Where welds are exposed to views, bevel members prior to welding and weld full. Grind welds flush, smooth, level with the adjacent surfaces. Grind welds at intersecting members to sharp lines. Galvanized metal welds shall be steel brushed to remove excess residue. Touch up by brushing or spraying galvanized gray primer.
- F. Holes: Accurately space to centers such that holes are not poorly or carelessly seamed.
- G. Anchorage: Fabricate and space anchoring devices to provide adequate support for intended use.
- H. Insulation of metals from contact with masonry and different metals from contact with each other shall be provided where necessary to prevent corrosion.
- I. Debur and grind smooth all welds and rough spots.
- J. All ornamental metal fabrications shall receive a sandblast finish to remove all oil, grease, lint, and rust.
- K. All ornamental metal fabrications shall receive 91-2 mil. zinc thermal sprayed metalized finish per ANSI/AWS C218.93, ASTM C633, ASTM B833-93, and SSPC-CS Guide 23.00, latest addition. Contact: Zinc Nation Inc. (714) 239-6190 www.zincnation.com. Contractor shall submit sample of metalizing for review and approval prior to metalizing ornamental metal items.
- L. Coating System
 - 1. Manufacturer
 - a. Tnemec Company Incorporated, 417 East Weber Street, Compton, CA 90222. Phone 310-637-2363. Web Site www.tnemec.com.
 - b. Equivalent materials of other manufacturers may be substituted only by approval of the architect. Requests for substitution shall include manufacturer's literature for each product giving the name, generic type, descriptive information solids by volume, recommended film thicknesses and a list of five projects where each product has been used and rendered satisfactory service. No request for substitution shall be considered that would decrease the film thickness or offer a change in the generic type of coating.
 - 2. Coating System Type
 - a. System Type: Hydrophobic Arcylic / HDP Pure Arcylic
 - b. Surface Preparation: Zinc thermal sprayed metalized finish
 - c. Intermediate Coat: Per Plan.
 - d. Finish Coat: Per Plan.
 - 3. Finish Color: As indicated on Plans.

2.10 Shop Painting:

- A. Shop Priming and Painting, General: Conform to SSPC Painting Manual.
- B. Products to be Primed: Prime paint after fabrication all parts not otherwise shown as galvanized, stainless steel, anodized aluminum, polished brass or embedded in concrete.
- C. Preparation for Priming: Prepare all surfaces to be coated, as follows.

1. Solvent-clean in accordance with SSPC-SP 1.
 2. Exterior fabrications: Clean in accordance with SSPC-SP 6.
 3. Interior fabrications: Clean in accordance with SSPC-SP 6.
- D. Shop Priming: Comply with SSPC-PA 1.
1. Apply primer immediately following surface preparation.
 2. Do not prime surfaces to be welded.
 3. Do not prime surfaces in direct contact bond with concrete or mortar.
 4. Spray apply shop prime without holidays, drips, runs.
 5. Provide two coats where product will not be finish painted or will be concealed in completed work.
 6. Apply an additional coat to corners, welds, edges, and fasteners.
- E. Drying: Allow paint to dry before handling.
- F. Steel Embedded in Concrete: Coat concealed faces with asphalt paint.
- G. Galvanizing Pre-Treatment: Where zinc-coated surfaces are specified to be shop primed, chemically treat surfaces to provide bond for paint before applying primer.
- H. Shop-Applied Finish Painting: Apply thermosetting enamel paint, gloss or semi-gloss, of a type and color as selected and approved by Engineer, if not otherwise specified.
1. Shop applied finish paint shall be baked to set and cure.
 2. Allow finish paint to thoroughly dry and cure before handling.

2.11 Rough Hardware:

- A. Rough Hardware, General: Provide bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as indicated on Plans.
- B. Rough Hardware Fabrication: Fabricate items to sizes, shapes, and dimensions required. Provide malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.12 Loose Bearing and Leveling Plates:

- A. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize fabrications after fabrication.

2.13 Other Fabrications:

- A. Other Fabrications: Provide fabrications not specifically described but required for a complete and proper installation, as selected by the Contractor, subject to approval of the Engineer.

PART - 3 EXECUTION**3.1 Preparation:**

- A. Preparation for Cutting and Fitting: Obtain Engineer's review prior to site cutting or making adjustments not indicated.
- B. Welding Preparation: Clean and strip site primed steel items to bare metal where site welding is indicated.
- C. Blocking and Bracing: Make provision for erection loads with temporary bracing. Keep work in alignment.
- D. Coordination with Cast in Place Concrete: Furnish setting templates and place items required to be cast into concrete, as specified in Section 03 20 00 - Reinforcing Steel (for Site Work) and Section 03 00 00 (for Building Work).

3.2 Installation, Typical:

- A. Installation, General: Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Field Welding: Perform field welding in accordance with AWS D1.1.

3.3 Cleaning and Touch-Up:

- A. Cleaning: Perform initial cleaning immediately after completion of installation. Prepare surfaces for finish painting as specified in Sections 09 91 13 & 09 91 23 – Exterior and Interior Painting.
- B. Galvanizing Touch-Up: Touch up galvanizing immediately after installation, including field welding. Prepare surface and apply cold galvanizing compound in compliance with the manufacturer's instructions and recommendations.
- C. Primer Paint Touch-Up: Immediately after erection or installation, touch up shop paint. Use products as specified in Sections 09 91 13 & 09 91 23 – Exterior and Interior Painting.
 - 1. Clean field welds, bolted joints, and areas where primer is damaged.
 - 2. Clean and primer paint welds and surrounding areas affected by welding.
 - 3. Paint with material used for shop painting, minimum 3 mils dry film thickness.
- D. Painting of Metal Fabrications:
 - 1. Exposed interior and exterior ferrous metal fabrications shall be coated (painted) as specified in Sections 09 91 13 & 09 91 23 – Exterior and Interior Painting.

3.4 Coatings System Application for Metalized Finish

A. Application

1. Apply coatings in accordance with manufacturer's instructions.
2. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
3. Keep containers closed when not in use to avoid contamination.
4. Do not use mixed coatings beyond pot life limits.
5. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
6. Uniformly apply coatings at spreading rate required to achieve specified DFT.
7. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
8. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

B. Repair

1. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
2. 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.
3. 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.

C. Cleaning

1. Remove temporary coverings and protection of surrounding areas and surfaces.

D. Protection of coating systems

1. Protect surfaces of coating systems from damage during construction.

END OF SECTION 05 70 00

**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 Scope:

Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the Contract, including, but not limited to these major items:

- Wood structural framing and partitions;
- Roof sheathing;
- Furring and stripping;
- Opening framing and curbs;
- Bridging, blocking, backing, nailers, ledger, bucks and grounds;
- Miscellaneous rough carpentry items as indicated and required for complete installation;
- All rough hardware.

1.2 Related Work Specified Elsewhere:

Finish Carpentry: Section 06 20 00.

Backpainting: Painting, Section 09 91 13 (Exterior) & 09 91 23 (Interior).

1.3 General Requirements:

- A. Field Conditions: Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces.
- B. Notes: General notes on the drawings are part of this section.

PART 2 - MATERIALS

2.1 Lumber: Manufactured, graded and grade-marked in compliance with the following reference specifications and grading rules. Grades and species as noted on drawings.

2.2 Glued Laminated Lumber: All glued laminated members shall be as specified on the structural drawings.

2.3 Rough Cut Lumber: All lumber referred to on the drawings as "rough cut" or "rough sawn" shall comply with the size and specifications for "full sawn" full dimension lumber, or "standard mill rough" lumber before surfacing four sides to net dimensions of standard finished lumber. Re-sawn or re-manufactured lumber from standard finished lumber sizes is not acceptable.

2.4 Douglas Fir:

- A. Grade in compliance with one of the following:

- 1. "Standard Grading and Dressing Rules No. 16 for Douglas Fir, West Coast Hemlock, Sitka Spruce, Western Red Cedar", by the West Coast Lumber Inspection Bureau.
- 2. "Grading Rules," latest edition, issued by the Western Wood Products Association, Portland, Oregon.

2.5 Plywood:

- A. U.S. Department of Commerce, Product Standard PS1-19, graded and grade-marked by the American Plywood Association.

1. Roof Sheathing. As noted on drawings, with waterproof glue.
2. Wall Sheathing. As noted on drawings, with waterproof glue.

2.6 Bolts:

- A. Conform to ASTM A307, Grade A, square or hexagonal head, sizes and spacing as required by the drawings. All heads and nuts bearing on wood shall be fitted with washers.
- B. Bolts, nuts and washers for use in locations subject to moisture, for outside use or in portions of the structure which are not completely enclosed, or elsewhere as specified or indicated: Galvanize in compliance with ASTM A153.

2.7 Nails:

- A. Sizes and types indicated, specified or required for the purpose, in compliance with FS FF-N-105A. Unless specified otherwise, use galvanized or aluminum nails for nailing redwood.
- B. Special Purpose Nails. As manufactured by the Independent Nail Corp., Bridgewater, MA, or similar and equal as manufactured by Philstone Nail Corp., Needham Heights, MA, or other as approved by the structural engineer. Requirements for galvanizing or other types of non-corrosive coating as specified above.
- C. "Screw-Tite" common spiral thread nails.
- D. "Screw-Tite" hardened steel, knurled masonry nails (0.148"-0.177 dia.) masonry nails (0.250" dia.).
- E. Concrete stub nails (0.148" dia.).
- F. Powder-actuated fasteners may be used only where specifically permitted hereinafter, or when subsequently approved, provided all available safety features and guards are used.
- G. Use low velocity equipment, if adequate. Submit detailed list of equipment and type of fasteners for owner's approval prior to use.

2.8 Timber Connectors: Refer to drawings.

2.9 Miscellaneous Materials: As hereinafter specified and as specified on the drawings.

2.10 Lumber Seasoning:

- A. Air or kiln dry lumber of grades better than No. 1 before surfacing to a moisture content not exceeding 19%. Before incorporation of Douglas Fir No. 1 or lower grades into the work, allow all lumber to attain a state of equilibrium with the local atmosphere. Air season all lumber not less than 30 days before covering with finish materials.
- B. If specifications for pressure treating state the maximum percentages of moisture content at the time of treatment, comply with those requirements.

2.11 Pressure Treatment - Material in Contact with Concrete:

Lumber in contact with concrete or masonry: Either Douglas Fir, Larch or Hemlock pressure treated in compliance with FS TT-W-5711. When treated members are cut to shape or size, perform such cutting or shaping before treatment. Where members are cut after treatment or countersunk for flush installation of bolt heads, paint the cut surfaces with two saturating coats of treating liquid before installation. Studs in contact with concrete floors shall be dipped in treatment solution to a height of

6'. Accepted Treatments:

<u>Preservative</u>	<u>Applicable FS for Formula</u>	<u>Final Retention lbs./cu.ft.</u>
Chromated Zinc Chloride	TT-W-551	0.75
Wolman Salts	TT-W-573	0.35
Acid Cupric Chromate	TT-W-546	0.50
Chemonite	TT-W-571c	0.30

PART 3 - EXECUTION

3.1 Carpentry Installation:

- A. Workmanship: Perform entire work in accordance with the best standards of practices relating to the trade and carefully plan and lay out the required work as required. Properly accommodate the work of other trades. Accurately saw-cut and fit lumber into the respective locations, true to line, grade, and level, as indicated or required, and permanently secure in proper position with spikes, nails, lag screws, bolts, hangers, or other fastenings to make the work substantial and rigid in all parts and connections.
- B. Connections: Make connections between members tight, accurate and secure. Place fastenings without splitting wood; pre-drill when required. Drill bolt holes same size as bolt diameter. Drill holes for lag screws same size as thread root diameter; and counterbore, same depth and diameter as shank. Turn lag screws into place, do not drive. Provide bolts and lag screws with washers under every head and nut bearing on wood. Tighten bolts and lag screws at installation; carefully retighten just prior to closing in or at completion of project.

3.2 Roof:

- A. Joist, beams and girders: Use longest practicable lengths, place with crown side up. Splice only over bearings. Cut in solid blocking at ends and over bearings. Double up all headers and trimmers wherever normal joist spacing is interrupted by mechanical work or any other penetration.
- B. Rafters: Place crown side up. Cut in solid blocking at ends and over bearings.
- C. Ledgers, headers and nailers: Accurately cut to required sizes and securely fasten to structure. Fasten wood nailers on steel frames with recessed bolt heads, installed with washers.
- D. Bridging: Provide bridging spaced 8' o.c. maximum, using full depth 2" thick solid blocking. Place at mid-span where span is greater than 8' and less than 16', or as otherwise shown.
- E. Plywood: All plywood nailing shall be inspected and approved before covering. Refer to drawings for nailing. Stagger joints.
- F. Framing Devices: Provide stock framing devices including joists hangers, 3-way framing anchors, clips, shear plates, metal straps, timber connectors, post caps, post anchors, and other stock iron work. Securely fasten to structure using size and quantity of nails, screws and bolts recommended by manufacturer of device, unless otherwise indicated. Drill holes for bolts in steel plates and angles 1/16" greater than bolt diameter.

3.3 Wood Stud Partitions and Walls:

- A. Plates: Doubled, with splices staggered at least 4' and with corners and intersections lapped and nailed.
- B. Studs adjacent to concrete or masonry: Attach with power-driven fasteners (three to each stud), unless otherwise indicated.

- C. Opening:. Frame openings with full height stud at each jamb with adjacent cripple supporting header and nailed to stud. Use single member headers, full width of studs, vertical dimension as indicated on drawings.
- D. Blocking: Provide fire stops at ceiling line, either composed of continuous plate or blocking of 2" x width of stud installed between studs. Provide intermediate blocking between floor and ceiling where required by code.
- E. Provide 2" thick blocking cut between studs and properly located where required for attachment of handrails, wall hung equipment, and similar accessories and equipment.
- F. Provide horizontal blocking installed at proper height above floor for installation of electrical switch boxes, receptacle boxes and similar items of equipment. This blocking may be omitted only where a stud is properly located for attachment of the box. Provide blocking to receive pail hook braces of service sinks.
- G. Frame out openings as required for installation of recessed equipment. Verify sizes from the trade furnishing the equipment.
- H. Corners and Intersections: Frame with at least three (3) studs.
- I. Cutting Limitations for Pipes and Conduits: (All cutting, boring, and metal reinforcing shall be performed by the sections affected.)
- J. Install all piping and conduit on the centerline of the partition: Do not install in notches cut in the face of the stud or plate except where reinforced with metal straps. Bore holes for passage of pipes and conduit no larger than 1/4" more than the outside diameter of the pipe or conduit and in no event larger than to leave a minimum of 1" of wood between the hole and face of stud.
- K. Where horizontal runs of piping are required, such horizontal piping may be installed in notches provided the pipe is located no closer than 1" from the face of the stud on either side and the notch bridged over with a metal strap or angle on plastered partitions or an angle on drywall partitions.
- L. Metal Strap: 13 gage x 12" long carbon steel, drilled or punched to receive three 8d "Holdfast" or "Screw Tite" spiral shank nails each end.
- M. Steel Angle: 1" x 1" x 1/8" steel angle nailed to face of stud as above specified. Install angle flush or slightly back from edge of stud to avoid interference with gypsum board of lath.
- N. Where necessary, plates may be cut in two, provided the cut is bridged with a metal strap or angle per Agency Representative's direction and the alignment of the plate is maintained.
- O. Furring and Strapping: Provide and shim where indicated or where necessary to align faces of finished materials in a single plane.

END OF SECTION 06 10 00

**SECTION 06 20 00
FINISH CARPENTRY**

PART 1 - GENERAL

1.1 SCOPE:

- A. All wood molding and trim.
- B. All fascias, etc.
- C. Installation of finish hardware, etc.
- D. Installation of doors and frames
- E. Exterior wood replacement & restoration.

1.2 RELATED WORK INCLUDED ELSEWHERE:

- A. Rough carpentry: Section 06 10 00.
- B. Back-painting: Painting, Section 09 91 13 (Exterior) & 09 91 23 (Interior).

1.3 QUALITY ASSURANCE:

- A. Except as otherwise shown or specified, comply with specified provisions of Woodwork Institute of California (WIC) "Manual of Millwork", "Custom Grade", using the most stringent joinery methods.
- B. Measurements. Before proceeding with woodwork required to be fitted to other construction, obtain measurements and verify dimensions and any shop drawing details as required for accurate fit.

1.4 SUBMITTALS:

- A. Shop Drawings, Architectural Woodwork. Submit six sets of shop drawings in accordance with Division 1, showing in complete detail all information required for fabrication, finishing and installation of this work.
- B. Certification, Architectural Woodwork. Before delivery of architectural woodwork items to job site, submit a WIC Certified Compliance Certificate indicating that woodwork meets the requirements of the Woodwork Institute of California for the specified grade or grades.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in area which meet the requirements specified for installation areas.

1.6 JOB CONDITIONS:

- A. Examination of Substrate and Conditions. The Installer must examine the substrate and the conditions under which the work under this section is to be performed, and notify the Contractor

in writing of any unsatisfactory conditions. Do not proceed with work under this section until satisfactory conditions have been corrected in a manner acceptable to the Installer.

- B. Protect installed woodwork from damage by other trades until owner's acceptance of the work. Advise Contractor of required protection procedures.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. All materials for work of this section shall be in accordance with the following grading rules: (Use latest edition of Standards.)
- B. All finish wood/lumber materials shall be kiln dried and shall not exceed a moisture content of 12%
- C. All Douglas fir finish lumber shall be manufactured and graded in accordance with AF&PA National Design Specifications (NDS), latest edition.
- D. All redwood finish lumber shall be manufactured and graded in accordance with "Standard Specifications or Grades of California Redwood Lumber of California Redwood Association," latest edition.
- E. All Ponderosa pine, Sugar pine, and White pine finish lumber shall be manufactured and graded in accordance with "Standard Grading Rules of Western Pine Association," latest edition.
- F. All Douglas fir plywood used as finish lumber on interior of building shall be "Interior Type," complying with "Product Standard PS 1-66" issued by the National Bureau of Standards, United States Department of Commerce. Grades shall be "A-A" for good two sides, "A-C" for good one side, and "A" selected by owner for exposed side scheduled for natural wood grain finish. Plywood for exterior use (at picnic shelters) shall be similar but shall be "exterior type" made with exterior type glue.

2.2 LOCATION OF FINISH LUMBER TO BE USED IN THE INTERIOR WORK:

- A. Unless noted otherwise, all exposed base and trim, when of wood, shall be Douglas fir, unless otherwise noted on the drawings.

2.3 INTERIOR FINISH LUMBER IN EXPOSED PORTIONS:

- A. All exposed moldings, trim and other wood finish members, shall be Vertical Grain Douglas fir, unless otherwise noted on the drawings.

2.4 EXTERIOR FINISH EXPOSED LUMBER:

- A. All eave fascias, stucco moldings and any other wood trim used to stop exterior plaster shall be "Clear All Heart" grade redwood, unless otherwise noted on the drawings.
- B. All exposed case work, jambs, trim, sills, and moldings, not used to stop plaster, shall be Douglas fir, "C and Btr.," vertical grain, unless otherwise noted on the drawings.

PART 3 - EXECUTION

3.1 GENERAL WORKMANSHIP:

- A. All finish carpentry work shall be done under direction of experienced carpentry foreman. Foreman shall plan and coordinate his work with work of all other trades so that all work may proceed in an orderly manner. All carpenters shall be skilled mechanics, experienced in finish

carpentry work.

- B. Exposed surfaces of interior wood finish and case work shall be thoroughly sandpapered with grain of wood free from sander marks, ready for painter's finish. Unless otherwise indicated or specified, all interior wood finish shall be secured to place with finish nails of proper sized set. All damage to exposed surfaces shall be carefully scraped out and hand sandpapered with grain of wood.
- C. Priming and backpainting: Exterior wood trim, interior wood finish and case work shall be primed or sealed and backpainting within 24 hours after delivery to building. Priming and backpainting is specified in the Painting Section.
- D. All interior wood finish shall be milled from kind of wood specified herein, or scheduled, or detailed. All wood finish shall be accurately scribed to contracting surfaces, joints metered, splices beveled and all joints tight. Trim shall be set plumb and level and adequately secured with finish nails of proper size, then set. All damage to exposed surfaces shall be scraped out and hand sanded ready for painter's finish.
- E. Refer to appendix 1, for the treatment of historic materials, including specification sections 01 35 91 & 06 01 40, for additional requirements for all building exterior work.

END OF SECTION 06 20 00

**SECTION 06 40 00
ARCHITECTURAL WOODWORK**

PART I-GENERAL

1.01 Related Work Specified Elsewhere:

Stripping, Blocking, Nailers and Rough Bases not part of Cabinets: Section 06 10 00
Finish Hardware not Furnished by Mill: Section 08 71 00.

1.02 Shop Drawings:

Submit six sets of shop drawings to architect for review.

Shop drawings shall show list of materials and hardware, sizes, sections, elevations and details of construction and assembly as required by Section 1, Millwork Shop Drawings of the WIC Manual of Millwork.

Shop drawings shall indicate all grounds, backing, blocking, sleepers and other items required for the installation of casework which are to be furnished and installed as part of the structure by the General Contractor.

The WIC Certified Compliance Grade Stamp indicating the grade specified shall be affixed to the Millwork Shop Drawings, certifying that the casework will be manufactured in accordance with the WIC grade specified.

1.03 Standards and Certification:

Before delivery to the job site, the fabricator shall issue a WIC Certified Compliance Certificate, certifying that the Plastic Covered Modular Casework products he will furnish for this project fully meets all requirements of "Custom" grade. The WIC Certified Compliance Grade Stamp shall be affixed to the casework shop drawings, certifying that the casework will be manufactured in accordance with WIC Deluxe grade. Further, each unit of Plastic Covered Modular Casework shall bear the WIC Certified Compliance Grade Stamp indicating "Custom" grade, and each Plastic Laminated Counter Top shall bear the Certified Compliance Grade Stamp indicating WIC "Custom" grade.

1.04 General:

Protect Millwork items against dampness during and after delivery. Wrap and/or store in clean well ventilated area where not exposed to extreme change of temperature and humidity.

Field measurements shall be made as required for the work of this section. Report any major discrepancy between the drawings and field dimensions to the Architect in writing.

Ensure that the most stringent standards for joinery are followed as they relate to any surface which could come in occasional or constant contact with water or elevated moisture/humidity.

PART II-PRODUCTS

2.01 General:

Manufacture casework in accordance with WIC (Woodwork Institute of California) Manual of Millwork,

Section 25A, Laminated Plastic Covered Modular Casework, Custom grade, except as modified hereinafter.

2.02 Modifications to WIC Manual:

All exposed corners of doors and drawers shall be radiused 1/4".

Dimensions and configurations of cabinets shall be as indicated on the drawings.

High pressure plastic laminate: Nevamar, Formica or Wilson-Art, conforming to NEMA LD-1 in colors as selected, 1/16" thick for countertops and work surfaces, and 1/32" thick for other surfaces.

Shelves: Shall be 3/4" thick for spans up to 35", and 1" thick for spans over 35" up to 48", and shall be adjustable to 1" centers. Metal shelf standards shall not be let into the end panels. Notch shelving to clear standards.

Metal strike plates: Provide all cabinet door and drawer locks with metal strike plates to protect against particle board rip-out.

Doors: Overlay type, hinged to swing flat against the face of adjoining cabinet or the side of cabinet, with radiused corners, and tee-edged with joint hidden under hinge. Do not notch door or cabinet ends, or divisions to receive hinge.

Cabinet interiors, including faces and edges of shelving therein, and interior door faces: Finish with 0.030 inch cabinet liner.

Toe kick base: Continuous 6' high ceramic tile or rubber base with 3/8" radius cove (as indicated on drawings) and formed interior and exterior corners.

2.03 Hardware:

Hinges: Heavy duty wrap-around offset for overlay doors with non-removable pin, dull chrome finish.

Pulls: Surface mounted aluminum US26D Quality #813, Stanley #4484, or equal.

Catches: Magnetic, National Lock #61-570, Stanley #41, or equal for doors with no locks. Federal Specification FF-H-111, Type F-1075-AC for inactive leaf of pairs of doors with locks.

Drawer slides: Full extension with no deflection, 1/2" slide space, 100 lb. load capacity.

Adjustable Shelf Standards: KV #255 with #256 shelf clips, Grant #125 with #21 shelf clips, or equal.

Door and Drawer locks: Corbin, Drawer Lock #0738, Door Lock #0737 for single doors and active leaf of pairs of doors, master keyed to match Owner's system. Provide two (2) keys for each lock. (Locks at all doors and drawers at all cabinets.)

Screws: Straight shank double thread particle board screws.

2.04 All plastic laminate shall be Nevamar or approved equal.

Color: To be selected by City staff from full color range available from manufacturer.

2.05 All countertops shall be Solid Surface. Color: Verify final color with City staff, selected from full color range available.

PART III-EXECUTION**3.01 Installation:**

All cabinet work shall be performed in the same shop with experienced journeymen personnel under the supervision of a thoroughly experienced foreman. Each cabinet shall be a complete and self-supporting web, as the cabinet condition may require.

Specified finish hardware shall be installed after all finish work has been completed. Inspect all drilling operations for surface splinters or delaminations. Any piece bearing such imperfections shall be rejected.

Unless otherwise indicated on the drawings, all countertops shall have self-edged fronts and edges and an integral coved backsplash. Where no splash occurs, scribe the back edge of the counter top to the wall. Extend back splash as shown on drawings.

Joints in the counter tops shall be secured with 1/8" x 3/4" cold-rolled steel straps at 3" o.c., the full length of all joints.

Adhesive shall be used under a cold-press method using a pressure of not less than 30 psi.

Completed tops shall be secured to the cabinets with #10 x 1 1/4" RHWS, minimum of 4 screws per cabinet. Additional screws shall be installed at the front and back of each cabinet on both sides of the counter top joints.

Install cove base (as indicated on drawings) on toe kick base in accordance with manufacturer recommendations.

Adhesive shall be used under a cold-press method using a pressure of not less than 30psi.

Completed tops shall be secured to the cabinets with #10 x 1 1/4" RHW, minimum of 4 screws per cabinet. Additional screws shall be installed at the front and back of each cabinet on both sides of the counter top joints.

Install rubber base on toe kick base in accordance with manufacturers recommendations.

Coordinate work with Divisions 15 and 16 for Mechanical, Plumbing, and Electrical work to be integrated into casework. All holes in counter tops used to run electric power chords, phone lines, cables, etc. shall be fitted with a rubber or plastic gromet with a color to match laminate.

3.02 Clean-Up:

Upon completion of installation and as a condition of final approval, all debris, sawdust, excess materials, packages, equipment and trash which may have resulted from this work, shall be removed from the site. All cabinet and millwork and adjacent surfaces shall be left clean and acceptable.

END OF SECTION 06 40 00

**SECTION 07 21 00
THERMAL INSULATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Loose-fill insulation.

B. Related Requirements:

1. Section 06 10 00 - "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
2. Section 07 54 19 - "Thermoplastic Membrane Roofing" for insulation specified as part of roofing construction.
3. Section 09 24 00 - "Portland Cement Plastering" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Glass-fiber blanket insulation.
2. Loose-fill insulation.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.
3. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATION SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Submit product data for each insulation type. See Section 01 34 00.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - MATERIALS

2.1 GLASS-FIBER BLANKET INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Corporation; CertaPRO® Sustainable Insulation or comparable product by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
 - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 - 3. Required R-values:
 - a. Roof areas between rafters: Minimum R-30.
 - b. All exterior **furred walls: Minimum R-13 at 2x4 stud walls, Minimum R-19 at 2x6 stud walls.**
 - c. All interior walls between conditioned spaces or restrooms **(as shown or noted on the plans): Minimum R-13 at 2x4 stud walls, Minimum R-19 at 2x6 stud walls.**
 - d. **Where occurs, insulation at ceilings shall be a minimum of R-19.**
 - e. **Where insulation is exposed at the roof in warehouse/storage areas or at Concession Building 'A' second floor, provide a white vinyl faced insulation.**

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.

- C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches (50 mm) between face of insulation and substrate to which anchor is attached.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Gemco.

- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. Adhesives shall have a VOC content of [70] <Insert value> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

- 2.5 **If** For all roof insulation and where otherwise required, support insulation with line wire at 12" O.C. perpendicular to bottom chord of rafters.

- 2.6 Thickness of insulation material shall be such that it will fit in the available space

without compressing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For wood-framed construction, install blankets in accordance with ASTM C1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
 - 6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Roof: Set units with facing placed toward interior of construction.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply in accordance with manufacturer's written instructions.

3.4 PROTECTION

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

END OF SECTION 07 21 00

**SECTION 07411
METAL ROOF PANELS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

The work includes, but is not necessarily limited to, furnishing and installation of all preformed metal roofing, and accessories as indicated on the drawings and specified herein.

1.02 RELATED SECTIONS

Edit for project conditions. Section Numbers indicated are those recommended by CSI Masterformat; revise if numbers differ from those used in Project Manual.

- A. Structural Steel Supports: Section 05 12 00
- B. Miscellaneous Fabricated Steel: Section 05 50 00
- C. Structural Lumber Supports: Section 06 10 00
- D. Thermal Insulation: Section 07 20 00
- E. Sheetmetal Gutters and Downspouts: Section 07 60 00
- F. Joint Sealants not specified herein: Section 07 90 00
- G. Finish Painting not specified herein: Section 09 91 23

1.03 PERFORMANCE REQUIREMENTS

A. TESTING AND CERTIFICATION

- 1. Wind Uplift:
 - a. The panel system shall be ASTM E1592 tested under the supervision of an accredited laboratory and the laboratory shall issue the test report.
 - 1. The testing laboratory shall meet the requirements for compliance with the ISO/IEC Standards 17025 or an accredited independent agency, recognized by the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement or ANSI.
 - b. UL 580 test, Class 90 rated per (select applicable construction):
 - 1. Construction #364 minimum 24 gauge panels when installed over 5/8" plywood, with roof panel fastener clips spaced 2'-0" on center maximum.
- 2. Air Infiltration: Panel to meet the following standard when in accordance with ASTM E-1680:
 - a. With factory-applied continuous sealant 0.08 cfm/lineal ft. of panel seam at 1.57 psf positive pressure, and 0.13 cfm/lineal ft. of panel seam at 1.57 psf negative pressure.
- 3. Water Penetration: Panel to meet the following standard when tested in accordance with ASTM-E1646:
 - a. With factory-applied continuous sealant, no leakage at 6.24 psf.

1.04 SUBMITTALS

A. PRODUCT DATA

1. Submit manufacturer's technical product data, installation instructions and recommendations for each type of roofing required. Include data substantiating that materials comply with requirements.

B. SAMPLES

1. Prior to ordering products, submit Manufacturer's standard color Samples for Architect's/Engineer's selection.
2. Prior to starting work, submit (quantity) 12" long Panel Samples showing shape and a representative color chip for Architect's/Engineer's acceptance.

C. SHOP DRAWINGS

1. Submit complete shop drawings detailing all perimeter flashings and joints in accordance with the manufacturer's standard recommendations.
2. Describe all proposed details that deviate from what is shown on the plans.
3. Details must allow for expansion and contraction.

D. DESIGN CRITERIA

1. Wind Uplift: The roof system manufacturer shall provide an attachment schedule or supporting calculations to resist the following uplift loads:
 - a. Uplift loads as calculated using the 2022 Edition of the CBC with a 110 MPH basic wind speed, Exposure Factor C, and importance Factor 1.0 (see Design Criteria table on structural plans).

1.05 QUALITY ASSURANCE

A. INSTALLER'S QUALIFICATIONS

1. Installer must be approved by the Panel Manufacturer in writing prior to work commencing.
2. Installer shall meet the following:
 - b. Successfully applied five metal roofs of comparable size and complexity which reflects a quality weathertight installation.
 - c. Have been in business for a minimum period of five years in the region where the work will be performed.

B. MANUFACTURER'S QUALIFICATIONS

1. Manufacturer shall have a minimum of 10 years experience supplying metal roofing to the region where the work is to be done.
2. Comply with current independent testing and certification as specified.
3. Manufacturer shall provide proof of \$2,000,000 liability insurance for their metal roof system and comply with current independent testing and certification as specified.
4. The roof panel manufacturer must also subscribe to Underwriters Laboratories' "Follow Up Service" assuring continuing product compliance with UL requirements. Shipment packaging of panels and attachment clips must bear UL classification markings.
5. Panel manufacturers without full supporting literature; Flashings & Details Guides, Guide Specifications and Technical Support, shall not be considered equal to the specified product.

C. REGULATORY AGENCY REQUIREMENTS

1. Comply with UBC and local Building Code requirements if more restrictive than those specified herein.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect against damage and discoloration.
- B. Handle panels with non-marring slings.
- C. Do not bend panels.
- D. Store panels above ground, with one end elevated for drainage.
- E. Protect panels against standing water and condensation between adjacent surfaces.
- F. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and allow to air dry.
- G. Painted panels shall be shipped with a protective plastic sheeting or a strippable film coating between all panels. [Remove any strippable film coating prior to installation and in any case, do not allow the strippable film coating to remain on the panels in extreme heat, cold, or direct sunlight or other UV source.]

1.07 PROJECT CONDITIONS

- A. Examine the conditions and substrates in which metal roofing work is to be installed. Substrate shall be installed level, flat and true to avoid panel stresses and distortion.
- B. Field measurements shall be taken prior to fabrication of panels.
- C. Proceed with roofing installation only after satisfactory conditions are met.

1.08 WARRANTY**A. MANUFACTURER'S PRODUCT WARRANTY**

- 1. Manufacturer's standard performance warranty, as available for specified installation and environmental conditions. (Contact an AEP Span representative to determine actual warranty criteria.)

B. CONTRACTOR'S WARRANTY

- 1. Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for two (2) years following Project Substantial Completion date.

C. MANUFACTURER'S WATERTIGHTNESS WARRANTY

- 1. Contact AEP Span sales department for watertightness warranty information.

PART 2 – PRODUCTS**2.01 ACCEPTABLE MANUFACTURER**

- A. AEP Span, A Division of ASC Profiles Inc, 2110 Enterprise Boulevard, West Sacramento, CA 95691
800-733-4955
Fontana: 10905 Beech Avenue, Fontana, California 92337
Tacoma: 2141 Milwaukee Way, Tacoma, Washington 98421
- B. PANEL DESIGNATION: Design Span® *hp*

- C. ALTERNATES: Approval of substitute systems is required prior to bid. The Architect will be the sole judge of what qualifies as an "equal" system. To be approved as an equal system, submit or respond to all items in "Quality Assurance", "Performance Requirements" and "Submittal" sections of this specification. All submittals must be received in the Architect's office a minimum of ten (10) working days prior to bid.

2.02 MATERIALS

A. PANELS

1. Base Metal:
 - a. Material: Steel conforming to: (choose one)
 - (1) ASTM A792 minimum yield 50,000 psi, thickness 24 gauge (standard).
 - b. Protective Coatings:
 - (1) Conform to ASTM A792, AZ50 (Zincalume®/Galvalume®).
2. Exterior Finish: (choose one)
 - a. DuraTech® 5000 (Polyvinylidene Fluoride), full 70% Kynar® 500/Hylar 5000® consisting of a baked-on 0.15-0.20 mil corrosion resistant primer and a baked-on 0.70-0.80 mil finish coat with a specular gloss of 10-30% when tested in accordance with ASTM D-523 at 60°.
 - b. Zincalume® Plus protective coating.
 - c. DuraTech® mx metallic finish, consisting of a baked-on primer (0.15-0.2 mil.) and a baked-on Polyvinylidene Fluoride finish coat (0.7-0.8 mil.) with a specular gloss of 20-35% when tested in accordance with ASTM D-523 at 60°.
3. Interior Finish:
 - a. Primer Coat Material: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; finish coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
 - b. Color: Off-White to Light Gray
4. Color:
 - a. Color as noted on the roof plans for each building
5. Factory-Applied Seam Sealant:
 - a. Cold-applied, non-skinning, butyl mastic sealant.
6. Configuration:
 - a. Standing Seam: Roof panels shall consist of integral self-locking standing seams 1-3/4" high spaced (choose one) 12", 16", or 18" on center. (17" available as non-standard width.) [choose one]
 - (1) Striated pan. (standard)

B. ACCESSORIES

1. Fastener Clip:
 - a. UL 90 rated 18 gauge G-90 Galvanized steel, 40 ksi yield strength, 3-1/2" long triple fastener type.
2. Fasteners:
 - a. Per manufacturer's recommendation.
3. Sealant:
 - a. Gunnable Grade Caulking: Single component polyurethane caulk.
 - b. Tape sealant: Butyl
4. Bearing Plate:

- a. 24 gauge 4"x6" Zinalume® coated steel bearing plate.

C. FLASHING

1. Material, gauge and finish to match panels. Do not use lead or copper.

D. FABRICATION

1. Unless otherwise shown on drawings or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.
2. Roofing panels shall be factory formed. Field formed panels are not acceptable.

PART 3 – EXECUTION

3.01 EXAMINATION

A. EXISTING CONDITIONS

1. Verify that members to receive panels are complete, accurately sized and located, in true plane, secure and otherwise properly prepared.
2. Prior to starting work, notify General Contractor about any defects requiring correction.
3. Do not start work until conditions are satisfactory.

3.02 PREPARATION

A. FIELD MEASUREMENTS

1. Verify prior to fabrication.
2. If field measurements differ from drawing dimensions, notify Architect/Engineer prior to fabrication.

B. PROTECTION

1. Treat, or isolate with protective material, and contacting surfaces of dissimilar materials to prevent electrolytic corrosion.
2. Require workmen who will be walking on Roofing Panels to wear clean, soft-soled work shoes that will not pick up stones or other abrasive material which could cause damage or discoloration.
3. Protect Work of other Trades against damage and discoloration.

C. SURFACE PREPARATION

1. Clean and dry surfaces prior to applying sealant.

3.03 INSTALLATION

A. PANELS

1. Follow roof panel manufacturer's directions.
2. Install panel seams vertically.
3. Lap panels away from prevailing wind direction.
4. Do not stretch or compress panel side-lap.
5. Secure panels without warp or deflection.
6. Fully engage interlocking seams.
7. Remove strippable protective film, if used, immediately preceding panel installation.

B. ALLOWABLE ERECTION TOLERANCE

1. Maximum Alignment Variation: 1/4 inch in 40 feet

C. FLASHING

1. Follow Manufacturer's directions and Architect approved Shop Drawings.
2. Install flashings to allow for thermal movement.
3. Remove strippable protective film, if used, immediately preceding flashing installation.

D. CUTTING AND FITTING

1. Neat, square and true. Torch cutting is prohibited.
2. Openings 6 inches and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.
3. Debur cut edge where necessary to saw-cut panels.

3.04 CLEAN UP AND CLOSE OUT

A. PANEL DAMAGE AND FINISH SCRATCHES

1. Do not apply touch-up paint to damaged paint areas that involve minor scratches.
2. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Architect's or Owner's representative.

B. CLEANING AND REPAIRING

1. At completion of each day's work and at work completion, sweep Panels, Flashings and Gutters clean. Do not allow fasteners, cuttings, filings or scraps to accumulate.
2. Remove debris from Project Site upon work completion or sooner, if directed.

END OF SECTION 07 41 10

SECTION 07 54 19
THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL CONDITIONS**1.1. DESCRIPTION**

1. Scope
Installation of a complete Sarnafil S327 Mechanically-Attached Sarnafast system including membrane, flashings and other components.
2. Related Work:
The work includes but is not limited to the installation of:
 - a. Substrate Preparation
 - b. Roof Drains
 - c. Vapor Retarder
 - d. Wood Blocking
 - e. Insulation
 - f. Separation Layers
 - g. Roof Membrane
 - h. Fasteners
 - i. Adhesive for Flashings
 - j. Roof Membrane Flashings
 - k. Walkways
 - l. Metal Flashings
 - m. Sealants
3. Upon successful completion of work the following warranties may be obtained:
 - a. Sika Corporation Warranty
 - b. Roofing Applicator Warranty

1.2. QUALITY ASSURANCE

1. This roofing system shall be applied only by a Roofing Applicator authorized by Sika Corporation prior to bid (Sika Corporation "Applicator").
2. Upon completion of the installation and the delivery to Sika Corporation by the Applicator of certification that all work has been done in strict accordance with the contract specifications and Sika Corporation's requirements, a Sika Corporation Technical Service Representative will review the installed roof system wherever a System Warranty has been specified.
3. There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative and Sika Corporation.
4. All work pertaining to the installation of Sarnafil membrane and flashings shall only be completed by Applicator personnel trained and authorized by Sika Corporation in those procedures.
5. Roofing membrane manufacturer must have a demonstrated performance history of producing PVC roof membranes no less, in duration of years, than the warranty duration specified.
6. Product to be manufactured by membrane supplier and not private labeled.
7. Manufacturer to have a minimum of five years experience recycling their membranes at the end of their service life back into new membrane products. Provide a minimum of five reference projects.

1.3. SUBMITTALS

At the time of bidding, the Applicator shall submit to the Owner (or Representative) the following:

1. Copies of Specification.
2. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.

3. Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.
4. Sample copy of Sika Corporation's warranty.
5. Sample copy of Applicator's warranty.
6. Dimensioned shop drawings which shall include:
 - a. Outline of roof with roof size and elevations shown.
 - b. Details of flashing methods for penetrations.
7. Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and other industry standards or practices.
8. Certification from the Applicator that the system specified meets all identified code and insurance requirements as required by the Specification.
9. Safety Data Sheets (SDS)

1.4. CODE REQUIREMENTS

The Applicator shall submit evidence that the proposed roof system meets the requirements of the 2022 California Building Code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

1. System shall be designed to meet a minimum wind design requirements of the most recent version of ASCE 7.
2. Factory Mutual Research Corporation (FM) - Norwood, MA
 - a. ~~Class 1-60~~
 - b. ~~Class 1-75~~
 - c. Class 1-90
3. Underwriters Laboratories, Inc. - Northbrook, IL
 - a. Class A assembly
 - b. ~~Class B assembly~~
 - c. ~~Class C assembly~~

1.5. PRODUCT DELIVERY, STORAGE AND HANDLING

1. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.
2. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.
3. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.
4. As a general rule all adhesives shall be stored at temperatures between 40°F (4°C) and 80°F (27°C). Read instructions contained on adhesive canister for specific storage instructions.
5. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.
6. Any materials which the Owner's representative or Sika Corporation determine to be damaged are to be removed from the job site and replaced at no cost to the Owner.
7. The existing pvc roof membrane is to be recycled by the manufacturer of the replacement membrane. Applicator is responsible for all costs associated with removing the membrane, preparing it and loading it for shipment, according to the manufacturer's published procedures.

1.6. JOB CONDITIONS

1. Sika Corporation materials may be installed under certain adverse weather conditions but only after consultation with Sika Corporation, as installation time and system integrity may be affected.

2. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be heat welded before leaving the job site that day.
3. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
4. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.
5. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.
6. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
7. The Applicator is cautioned that certain Sarnafil membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with Sarnafil membranes. The Applicator shall consult Sika Corporation regarding compatibility, precautions and recommendations.
8. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over Sarnafelt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.
9. Prior to and during application, all dirt, debris and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air or similar methods.
10. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.
11. All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.
12. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.
13. The Applicator shall take precautions that storage and application of materials and equipment does not overload the roof deck or building structure.
14. Installation of a Sarnafil membrane over coal tar pitch or a resaturated roof requires special consideration to protect the Sarnafil membrane from volatile fumes and materials. Consult Sika Corporation for precautions prior to bid.
15. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.
16. All rooftop contamination that is anticipated or that is occurring shall be reported to Sika Corporation to determine the corrective steps to be taken.
17. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing (letter copy to Sika Corporation) to the Owner's Representative for corrective action prior to the installation of the Sika Corporation roof system.
18. Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense (letter copy to Sika Corporation).
19. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.
20. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.

21. The Applicator shall conduct fastener pullout tests in accordance with the latest version of the SPRI/ANSI Fastener Pullout Standard to verify condition of the deck/substrate and to confirm expected pullout values.
22. The Sarnafil membrane shall not be installed under the following conditions without consulting Sika Corporation's Technical Dept. for precautionary steps:
 - a. The roof assembly permits interior air to pressurize the membrane underside.
 - b. Any exterior wall has 10 percent or more of the surface area comprised of opening doors or windows.
 - c. The wall/deck intersection permits air entry into the wall flashing area.
23. Precautions shall be taken when using Sarnacol adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.
24. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.
25. Sarnafil membranes are slippery when wet or covered with snow, frost, or ice. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.

1.7. BIDDING REQUIREMENTS

1. Pre-Bid Meeting:
A pre-bid meeting shall be held with the General Contractor and involved trades to discuss all aspects of the project. The Applicator's field representative or roofing foreman for the work shall be in attendance. Procedures to avoid rooftop damage by other trades shall be determined.
2. Site Visit:
Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the Applicator. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

1.8. WARRANTIES

1. Sika Corporation Warranty
Upon successful completion of the work to Sika Corporation's satisfaction and receipt of final payment, the Sika Corporation Warranty shall be issued.
 - a. Membrane Warranty
 - b. System Warranty (only products purchased from Sika Corporation are covered under System Warranty)
2. Applicator/Roofing Contractor Warranty
Applicator shall supply Owner with a separate workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with Contract Documents, the Applicator shall repair that defect at no cost to the Owner. Applicator's warranty obligation shall run directly to Owner, and a copy shall be sent to Sika Corporation.
3. Owner Responsibility
Owner shall notify both Sika Corporation and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

1.9. WARRANTY DURATIONS

1. Sika Corporation's warranty shall be in effect for a 20 year duration.
2. Applicator's/Roofing Contractor's Warranty shall be in effect for a one year duration.

PART 2 - PRODUCTS**2.1. GENERAL**

1. Components of the roof system are to be products of Sika Corporation as indicated on the Detail Drawings and specified in the Contract Documents.
2. Components to be used that are other than those supplied or manufactured by Sika Corporation may be submitted for review and acceptance by Sika Corporation. Sika Corporation's acceptance of any other product is only for a determination of compatibility with Sika Corporation products and not for inclusion in the Sika Corporation warranty. The specifications, installation instructions, limitations, and restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with Sika Corporation products.
3. Special consideration should be given to construction related moisture. An example is ~~to~~ significant amount of moisture generated when concrete floor slabs are poured ~~after~~ the roof has been installed. Sika Corporation is not responsible for damage to the insulation when exposed to construction related moisture.
4. Consult respective product data sheets for additional information.

2.2. MEMBRANE

1. Membrane shall conform to:
ASTM D4434 (latest version), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type III.
 - a. NSF/ANSI Standard 347, "Sustainability Assessment for Single Ply Roofing Membranes". Certification Level: Platinum.
 - b. The manufacture to guarantee that the membrane thickness meets or exceeds [the specified thickness] when tested according to ASTM D751
2. Sarnafil S327 thermoplastic membrane with polyester reinforcement, lacquer coating, and with a factory applied 9 oz. geotextile felt backing.
3. Thickness
 - a. Sarnafil S327-18, 80 mil
4. Color of Membrane
 - a. EnergySmart White, initial solar reflectance of 0.83, emittance of 0.90, and solar reflective index (SRI) of 104 (ENERGY STAR listed).
5. Typical Physical Properties ⁽¹⁾
 - a. See Table on next sheet.

Property	ASTM Test Method	ASTM Type III D-4434 Spec. Requirement	Typical Results			
Overall Thickness, mil	D751	45	48	60	72	80
Thickness Over Scrim, mil	--	16	21	27	35	40
Reinforcing Material	--	--	Polyester	Polyester	Polyester	Polyester
Felt Weight, oz/yd ² (feltback membrane only)	--	--	9	9	9	9
Breaking Strength, lbf/in (N)	D751	200 (890)	295 (1312)	305 (1356)	315 (1401)	325 (1445)
Elongation at Break, % M. D. ¹ & C.M.D. ¹	D751	15 & 15	27.5 & 28.5	28.5 & 29.5	29 & 30	29.5 & 30.5
Seam Strength, % of original ²	D751	75	Pass	Pass	Pass	Pass
Retention of Properties After Heat Aging	D3045	--	--	--	--	--
Tensile Strength, % of original	D751	90	Pass	Pass	Pass	Pass
Elongation, % of original	D751	90	Pass	Pass	Pass	Pass
Tearing Resistance, lbf (N)	D1004	45 (200)	47 (209)	48 (213)	48.5 (216)	49 (218)
Low Temperature Bend, -40°F (-40°C)	D2136	Pass	Pass	Pass	Pass	Pass
Accelerated Weathering Test (Fluorescent Light UV exposure), Hours	G154	5,000	10,000	10,000	10,000	10,000
Cracking (7x magnification)	--	None	None	None	None	None
Discoloration (by observation)	--	Negligible	Negligible	Negligible	Negligible	Negligible
Crazing (7x magnification)	--	None	None	None	None	None
Linear Dimensional Change, %	D1204	0.5	-0.10	-0.12	-0.13	-0.14
Weight Change After Immersion in Water, %	D570	± 3.0	2.2	2.0	1.8	1.8
Static Puncture Resistance	D5602	Pass	Pass	Pass	Pass	Pass
Dynamic Puncture Resistance, ft-lbf (J)	D5635	14.7 (20)	Pass	Pass	Pass	Pass
Recycled Content (10' & 5' sheet only)	9% Pre-Consumer / 1% Post-Consumer					

* Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions, and curing conditions.

1 M.D. = Machine Direction, C.M.D. = Cross Machine Direction

2 Failure occurs through membrane rupture not seam failure.

2. 3. FLASHING MATERIALS

1. Wall / Curb Flashing: Provide flashings per manufacturer's specifications & details for the appropriate condition including, but not limited to the following:
 - a. Sarnafil G410 Membrane: Fiberglass reinforced membrane adhered to approved substrates using Sarnacol adhesive.
 - b. ~~G459 Flashing Membrane: Fiberglass reinforced membrane adhered to asphalt, other contaminated surfaces, or approved substrates using Sarnacol adhesive. G459 comes in 6.5' and 3.25' widths and is 60 mil (1.5mm) thick. The standard color is white on tan. The tan side of the membrane must be the side exposed to the contamination.~~
 - c. Sarnaclad: PVC-coated, heat-weldable sheet metal capable of being formed into a

- variety of shapes and profiles. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported Sarnafil membrane laminated on one side. The dimensions of Sarnaclad are 4 ft x 8 ft (1.2 m x 2.4 m) or 4 ft x 10 ft (1.2 m x 3.0 m).
2. Perimeter Edge Flashing: Provide flashings per manufacturer's specifications & details:
 - a. ~~TerminEdge EX Fascia: ES-1 tested product. Edge Grip Fascia: Prefabricated perimeter edge system provided by Sika Corporation. The system has concealed fasteners with no penetrations on the horizontal roof surface and includes fasteners and splice plates. Edge Grip is made from two distinct parts. A rigid retainer base plate and a decorative snap-on fascia cover. The retainer is made from 20-gauge galvanized steel in 10 foot (3048 mm) standard lengths and is provided with 9/32 inch (7 mm) slotted pre-punched holes for fastener spacing at 12 inches (152 mm) on center. As an option the retainer base plate is also available in 0.05 inch (1.3 mm) aluminum. The snap-on fascia cover is available in 10 foot (3048 mm) lengths and in a variety of thickness, colors, finishes, and widths. Kynar 500 colors are available for galvanized steel and natural mill finished aluminum. Clear and anodized colors are available for anodized finished aluminum. Matching corners, end caps, fascia sumps, spillouts, etc. are available as accessories.~~
 - i. ~~Retainer base plate shall be 20-gauge galvanized steel in 10 ft. lengths.~~
 - ii. ~~Snap-on fascia cover shall be 24-gauge galvanized steel in 10 ft. lengths.~~
 - iii. ~~Snap-on fascia cover shall have a Kynar finish.~~
 3. Miscellaneous Flashing: Provide flashings per manufacturer's specifications & details for the appropriate condition including, but not limited to the following:
 - a. Detail Membrane: 60 mil (1.5 mm) fiberglass reinforced membrane, available 12" x 50' (30.5 cm x 15.2 m) roll and 24" x 50' (61 cm x 15.2 m) roll, more pliable than Sarnafil G410 membrane, good use for flashing pipes, corners, and unusual shaped penetrations.
 - i. Sarnacircles: 60 mil (1.5mm) thick prefabricated 4 1/2 in. round circle patch injection molded.
 - ii. Sarnacorners – Inside: 60 mil (1.5 mm) thick prefabricated inside corner injection molded.
 - iii. Sarnacorners – Outside: 60 mil (1.5 mm) thick prefabricated outside corner injection molded.
 - iv. Sarnastack Universal, A, B, or C: 60 mil (1.5 mm) thick prefabricated stack/pipe boot injection molded.
 - v. Open Post Flashing: 48 mil (1.2 mm) thick prefabricated flashing using weld technology convenient to flash obstructed rooftop conduits and pipes. Open post flashings are fabricated with an open seam and are available in different sizes.
 - vi. Sarnareglet: Heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Sarnareglet is produced from 6063-T5, 0.10 inch to 0.12 inch (2.5 mm to 3.0 mm) thick extruded aluminum. Sarnareglet has a 2-1/4 inch (57 mm) deep profile, and is provided in 10 foot (3 m) lengths. Use prefabricated Sarnareglet mitered inside and outside corners where walls intersect.
 - vii. Sarnadrain – Ufl: Seamless heavy-duty aluminum drain, featuring a coated flange for hot air welding of Sarnafil membranes. Sarnadrain-Uflow consists of a one-piece spun, 0.125 in.(3.175 mm), 11 gauge thick aluminum body, a 17.5" (445 mm) diameter, and a 12" (305 mm) long drain stem.
 - viii. ~~Sarnacol 2170 Adhesive: Solvent-based reactivating adhesive used to attach membrane to flashing substrate. Typical flashing substrate coverage rate is 45-60ft²/gal (1.10-1.47m²/L).~~
 - ix. ~~Sarnacol 2170 VC Adhesive: Solvent-based, VOC compliant, reactivating adhesive used to attach membrane to flashing substrate. Typical flashing substrate coverage rate is 45-60ft²/gal (1.10-1.47m²/L).~~
 - x. ~~Sarnafelt: Leveling and/or separation layer that is necessary behind Sarnafil G410 or G459 Flashing Membrane when the flashing substrates are rough or incompatible with the flashing membrane. When Sarnafelt is used as a leveling and/or separating layer a 2nd coat on the dried substrate at the~~

~~same rate is required to adhere the felt and then the membrane.~~

- xi. Liquid Flashing Primer: Two-component polymethyl methacrylate-based (PMMA) primer used to promote the adhesion of Liquid Flashing SW and Liquid Flashing WW over wood and concrete surfaces in Sarnafil® and Sikaplan® roofing details.
- xii. Liquid Flashing Fleece: Non-woven, needle-punched polyester fleece used as the reinforcement for Sika's liquid flashing details in Sarnafil® and Sikaplan® roofing systems.
- xiii. Liquid Flashing Catalyst: Reactive agent based on dibenzoyl peroxide to induce curing of Sika's Liquid Flashing SW, Liquid Flashing WW, and Liquid Flashing Primer when mixed.
- xiv. Liquid Flashing SW (summer-grade white): Two-component polymethyl methacrylate-based (PMMA) liquid flashing material used in Sarnafil® and Sikaplan® roofing details. Liquid Flashing SW is used with Liquid Flashing Fleece and cures to form a monolithic reinforced flashing membrane.
- ~~xv. Liquid Flashing WW (winter-grade white): Two-component polymethyl methacrylate-based (PMMA) liquid flashing material used in Sarnafil® and Sikaplan® roofing details. Liquid Flashing WW is used with Liquid Flashing Fleece and cures to form a monolithic reinforced flashing membrane. The ambient and surface temperatures at application must be between 23°F (-5°C) and 68°F (20°C).~~

2.4. INSULATIONS / ROOF BOARDS

- 1. Sarnatherm XPS: Closed-cell extruded polystyrene foam insulation board with a smooth skin surface on the face and back surfaces. Available in 2 ft x 8 ft (0.6 m x 2.4 m) or 4 ft x 8 ft (1.2 m x 2.4 m) flat or tapered sizes in various thicknesses and compressive strengths.
- 2. DensDeck Prime: Fiberglass mats front and back that are bonded to a high density gypsum core. DensDeck Prime is provided in 4 ft. x 4 ft. (1.2 m x 1.2 m) or 4 x 8 ft (1.2 x 2.4 m) board sizes and in thicknesses of 5/8 inch (6, 13 and 16 mm).

2.5. ATTACHMENT COMPONENTS

- 1. Membrane Adhesive: Provide adhesives per manufacturer's specifications & details for the appropriate condition including, but not limited to the following:
 - ~~a. Sikaplan water based Adhesive: Sikaplan Water Based Membrane Adhesive is a water-based dispersion adhesive used within a Sikaplan Adhered roofing system.~~
 - b. Sarnacol 2121 Adhesive: Water-based adhesive used to attach the membrane to horizontal or near-horizontal substrates.

SARNACOL 2121 COVERAGE RATES FOR BAREBACK MEMBRANE		
Substrate	Roller Applied Total Rate	Spray Applied Total Rate
Polyisocyanurate Felt Facer	100 ft ² /gal (2.47 m ² /L)	133 ft ² /gal (3.27m ² /L)
Polyisocyanurate Glass Facer	100 ft ² /gal (2.47 m ² /L)	133 ft ² /gal (3.27m ² /L)
Smooth Plywood	100 ft ² /gal (2.47 m ² /L)	133 ft ² /gal (3.27m ² /L)
DensDeck	100 ft ² /gal (2.47 m ² /L)	133 ft ² /gal (3.27m ² /L)
DensDeck Prime	100 ft ² /gal (2.47 m ² /L)	133 ft ² /gal (3.27m ² /L)

- 2. Insulation / Roof Board Adhesive

- a. Sarnacol 2163: Two component foamable polyurethane board adhesive that is applied in one step and sets up in minutes. Dispensed using 1.5 L (0.4 gal) dual cartridges. No temperature restrictions.
 - b. Sarnacol AD Board Adhesive: Two component foamable polyurethane adhesive that is applied in one step and sets up in minutes. Dispensed using holders and hoses, available in 10 gal, 30 gal, or 100 gal sets. The minimum ambient and surface temperatures is 40°F (4.4°C) and rising.
 - c. Sarnacol OM Board Adhesive 1.5 L Cartridge & 10 Gallon Set: Two component foamable polyurethane adhesive that is applied in one step and sets up in minutes. Dispensed using 1.5 L (0.4 gal) dual cartridges or holders and hoses, available in 10 gal sets. The minimum ambient and surface temperatures is 40°F (4.4°C) and rising.
 - d. Sarnacol OM Board Adhesive 30 & 110 Gallon Sets: Two component foamable polyurethane adhesive that is applied in one step and sets up in minutes. Dispensed using high pressure spray applicator, available in 30 gal or 110 gal sets. The minimum ambient and surface temperatures is 40°F (4.4°C) and rising.
 - e. Sarnacol OM Board Adhesive WG (winter grade): Two component foamable polyurethane adhesive that is applied in one step and sets up in minutes. Dispensed using 1.5 L (0.4 gal) dual cartridges. Applied in temperatures between 0°F (-18°C) and 65°F (18°C).
3. Insulation:
- a. Sarnafastener #15 XP: #15 corrosion-resistant fastener used with Sarnaplates to attach insulation and/or roof boards to steel roof decks. Sarnafastener #15 XP has a shank diameter of approximately 0.21 inch (5.3 mm) and the thread diameter is approximately 0.26 inch (6.6 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.

2.6. DECK PRIMERS

1. Vapor Retarder Primer SB: Solvent based primer used to prime wood, concrete, lightweight concrete, gypsum boards and decks, and DensDeck® boards prior to the application of Sika's self-adhered vapor retarders.
2. Vapor Retarder Primer VC: VOC Compliant*, solvent-based primer used to prime wood, concrete, lightweight concrete, gypsum boards and decks, and DensDeck® boards prior to the application of Sika's self-adhered vapor retarders.
3. Vapor Retarder Primer WB (water based): Polymer emulsion based primer used to prime wood, concrete, lightweight concrete, gypsum decks, and approved gypsum boards prior to the application of Sika's self-adhered vapor retarders. Particularly recommended when the use of solvent based primer is not advised and/or not permitted.
4. Vapor Retarder Primer TA: Blend of bitumen and solvents for use on concrete decks to applying Sika's torch-applied vapor retarders. The primer improves the adhesion of Sika's torch-applied vapor retarders to the properly prepared and fully dry concrete surface.

2.7. VAPOR RETARDERS

1. Vapor Retarder PE 10: 10 mil (0.25 mm) thick polyethylene vapor retarder/air barrier.
2. Vapor Retarder SA 31: 31 mil (0.8 mm) thick self-adhered SBS modified bitumen vapor retarder/air barrier with a tri-laminated woven polyethylene facer. Can also serve as temporary roof protection exposed for up to three (3) months.
3. Vapor Retarder SA 106: 106 mil (2.7 mm) thick self-adhered SBS polymer modified bitumen vapor retarder/air barrier with a non-woven polyester mat reinforcement and fine mineral aggregate (sand) topside. Can also serve as temporary roof protection exposed for up to three (6) months.
4. Vapor Retarder TA 138: 138 mil (3.5 mm) thick torch applied SBS polymer modified bitumen vapor retarder with a non-woven polyester mat reinforcement and fine mineral aggregate (sand) topside. Can also serve as temporary roof protection exposed for up to three (6) months.
5. Ply Sheet HA 87: 87 mil (2.2 mm) thick hot applied SBS polymer modified bitumen with

- ~~fiberglass mat reinforcement and fine mineral aggregate (sand) topside and underside. Can also serve as temporary roof protection exposed for up to three (6) months.~~
- ~~6. Ply Sheet TA 87: 87 mil (2.2 mm) thick torch applied SBS polymer modified bitumen with a fiberglass mat reinforcement and fine mineral aggregate (sand) topside and polyolefin burn-off film underside. Can also serve as temporary roof protection exposed for up to three (6) months.~~

2.8. WALKWAY PROTECTION

1. Sarnatred-V : Polyester reinforced, 0.096 inch (96 mil/2.4 mm), weldable membrane with surface embossment similar to a chevron pattern. Used as a protection layer from rooftop traffic. Sarnatred-V is supplied in rolls of 39 inches (1.0 m) wide and 50 feet (15 m) long.

2.9. MISCELLANEOUS ACCESSORIES

1. Sarnamatic 641mc, 661, or 681: 220 volt, self-propelled, hot-air welding machine used to seal Sarnafil membrane seams.
2. Aluminum Tape: 2 inch (50 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Sarnaclad joints.
3. Multi-Purpose Tape: High performance sealant tape used with metal flashings as a preventive measure against air and wind blown moisture entry.
4. Perimeter Warning Tape: Designed for use on PVC membranes as a reflective, highly visible pressure sensitive tape used to draw attention to roof perimeters and potential hazardous areas. The tape is available in 2 inch wide rolls by 30 feet long and comes on a release liner for easy application. Perimeter Warning Tape exceeds reflectivity 3 requirements and Federal spec. L-S-300, Class 1.
5. Perimeter Warning Membrane: The Perimeter Warning Membrane is made from Sarnafil G410 membrane, Yellow in color, and is 4" (101mm) wide and 100' (30m) long.
6. Seam Cleaner: Seam Cleaner is used on PVC membranes to clean the in the seam area only.
7. Sarnastop: Extruded aluminum, low profile bar used with certain Sarnafasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Sarnastop is a 1 inch (25 mm) wide, flat aluminum bar 1/8 inch (3 mm) thick that has predrilled holes every 6 inches (152 mm) on center.
- ~~8. Sarnabar: FM approved, heavy duty, 14 gauge, galvanized or stainless, roll formed steel bar used to attach membrane to roof decks. The formed steel is pre-punched with holes every 1 inch (25 mm) on center to allow various Sarnafastener spacing options.~~
9. Sarnacord: 5/32 inch (4 mm) diameter, red-colored, flexible thermoplastic extrusion that is welded to the top surface of the Sarnafil membrane and against the side of the Sarnabar, used to hold the membrane in position.

2.10. SEALANTS AND PITCH POCKET FILLERS

1. Sikaflex-1a (for termination details and pitch pocket toppings).
- ~~2. Sarnafiller (two component urethane adhesive for pitch pocket toppings).~~
3. Mastic: Cold applied, fiber reinforced high strength SBS modified bitumen mastic that is specially formulated to detail around penetrations and flashings where Sika vapor retarders and hybrid system ply sheets are used.
4. Depending on substrates, the following sealants are options for temporary overnight tie-ins:
 - a. Type III hot asphalt conforming to ASTM D312 (latest revision).
 - b. Sarnafiller.
 - c. Multiple layers of roofing cement and felt.
 - d. Spray-applied, water-resistant urethane foam.
 - e. Mechanical attachment with rigid bars and compressed sealant.

2.11. MISCELLANEOUS FASTENERS AND ANCHORS

All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch (32 mm) and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch (25 mm) and shall be approved for such use by the fastener manufacturer.

2.12. RELATED MATERIALS

1. Wood Nailer: Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on Project Drawings. Thickness of nailers must match the insulation thickness to achieve a smooth transition. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated) and be #2 quality or better lumber. Creosote or asphalt-treated wood is not acceptable. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49. All wood shall have a maximum moisture content of 19 percent by weight on a dry-weight basis.
2. Plywood: When bonding directly to plywood, a minimum 1/2 inch (12 mm) CDX (C side out), smooth-surfaced exterior grade plywood with exterior grade glue shall be used. Rough-surfaced plywood or high fastener heads will require the use of Samafelt behind the flashing membrane. Plywood shall have a maximum moisture content of 19 percent by weight on a dry weight basis.

PART 3 -EXECUTION

3.1. PRE-CONSTRUCTION CONFERENCE

1. The Applicator, Owner's Representative/Designer and Manufacturer(s) shall attend a pre-construction conference.
2. The meeting shall discuss all aspects of the project including but not limited to:
 - a. Safety
 - b. Set up
 - c. Construction schedule
 - d. Contract conditions
 - e. Coordination of the work

3.2. SUBSTRATE CONDITION

1. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.
2. Applicator shall verify that the work done under related sections meets the following conditions:
 - a. Roof drains and scuppers have been reconditioned or replaced and installed properly.
 - b. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
 - c. All surfaces are smooth and free of dirt, debris and incompatible materials.
 - d. All roof surfaces shall be free of water, ice and snow.

3.3. SUBSTRATE PREPARATION

The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner as to eliminate risk of deck overload due to concentrated weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

1. New Construction

- a. Wood Deck:
The roof deck shall be minimum 1-1/2 inch (38 mm) thick lumber or 15/32 inch (12 mm) thick plywood. Deck shall be installed according to local code requirements. Contact Sika Corporation Technical for fastening patterns and methods.
- ~~b. Insulating Fill Substrate:
The lightweight fill shall be installed by a trained lightweight fill Applicator in accordance with the lightweight fill manufacturer's requirements and industry practice. The surface shall be free from dust and loose fragments, be smooth, level, and free from moisture. Sharp ridges or other projections above the surface shall be removed before roofing. Proper venting as recommended by the roof deck manufacturer shall be provided. An insulation recover board is required as a substrate to adhere to. Fastening shall be into the structural deck below the insulating fill (see steel/concrete deck requirements).~~
- ~~c. Cementitious Wood Fiber Panel Deck:
The roof deck shall be installed in accordance with the deck manufacturer's requirements and industry practice. The surface shall have a smooth and level finish and shall be free of dust, moisture and loose debris. All voids and joints shall be grouted. Any differentials in height between precast units shall be feathered for a smooth transition. Sharp ridges or other projections above the surface shall be removed before roofing. Panels shall be secured to structural supports as recommended by the deck manufacturer.~~

3.4. SUBSTRATE INSPECTION

1. A dry, clean and smooth substrate shall be prepared to receive the Sika Corporation Sarnafast mechanically-attached roof system.
2. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.
3. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.
4. All roof surfaces shall be free of water, ice and snow.
5. Sarnafil shall be applied over compatible and accepted substrates only.

3.5. VAPOR RETARDER INSTALLATION

General Criteria:

Interior (inside temperature/relative humidity) or exterior conditions may create a need for a vapor barrier. The design professional shall decide whether a vapor barrier is necessary. It is the design professional's responsibility to determine the type and location of a vapor barrier. If sealed properly, a vapor barrier can also act as an air barrier (positive pressure) for roofs intended over air-permeable decks (steel, wood, precast, etc.). When reroofing over the existing asphalt roof, the old roof may be considered to be an adequate vapor barrier/air barrier if the details are properly sealed.

- ~~1. Vapor Retarder PE 10
Vapor Retarder PE 10 is loose laid over suitable substrates. Overlap all edges a minimum of 4 in (10.2 cm) and seal with Sika's Multi-Purpose Tape. Extend Vapor Retarder PE 10 to the perimeter and deck penetrations and seal with Sika's Multi-Purpose Tape to provide continuity of the air/vapor envelope. Seal Vapor Retarder PE 10 with Sika's Multi-Purpose Tape on the vertical surface at roof penetrations.~~
2. Vapor Retarder SA 31
 - a. All surfaces must be clean, sound, dry, and free of loose materials or contaminants such as water, frost, ice, oil and grease that would interfere with proper adhesion and compromise the performance of the product.
 - b. Prepare concrete surfaces to achieve a Concrete Surface Profile CSP 3 to CSP 5 in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R-2013.
 - c. Vapor Retarder Primer SB, Vapor Retarder Primer VC or Vapor Retarder Primer WB

is required on all substrates except for steel. Shake or stir primer before applying. Let the primer dry completely.

- d. Begin the installation at the low point of the roof. Unroll Vapor Retarder SA 31 onto the substrate for alignment. Overlap each sheet by 3 in (7.6 cm) on the side lap and 6 in (15.2 cm) on the end laps.
- e. Once the roll is aligned, peel back a portion of the silicone release film and press Vapor Retarder SA 31 onto the substrate. When securely adhered, remove the remaining release film from the roll.
- f. On steel decks install a 6 in x 42 in (15.2 cm x 1.1 m) metal plate under the end lap to support the membrane between the steel flutes. Stagger the end laps by at least 12 in (30.5 cm).
- g. Use a minimum 100 lb (45 kg) steel roller to press the Vapor Retarder SA 31 onto the substrate including the laps. Use the roller to push out any air bubbles out to the edge of the membrane. Do not cut the membrane to remove a bubble.
- h. Apply Sika's Mastic to seal around penetrations, T-joints, and fishmouths. Use a trowel to mound the Mastic around the penetrations to seal the opening. Do not apply Mastic where it may come into direct contact with the membrane.

3. Vapor Retarder SA 106

- a. All surfaces must be clean, smooth, sound, dry, and free of loose materials, debris or contaminants such as water, moisture, frost, ice, oil and grease that would interfere with proper adhesion and compromise the performance of the product.
- b. Prepare concrete surfaces to achieve a Concrete Surface Profile CSP 3 to CSP 5 in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R-2013.
- c. Vapor Retarder Primer SB, Vapor Retarder Primer VC or Vapor Retarder Primer WB is required on all substrates except for steel. Concrete surfaces must be dry before installation. Shake or stir primer before applying. Let the primer dry completely.
- d. Begin the installation at the low point of the roof. Chalk a line on the deck to align the sheet. Unroll, position, and align Vapor Retarder SA 106 with the release poly covered selvage edge on the up slope side. After the sheet is placed in its final position, loosely reroll half of the sheet toward the center of the roll.
- e. Carefully score the release liner across the width of the roll with a straight blade utility knife. Roll Vapor Retarder SA 106 into its final position as the release liner is being removed. Re-roll the remaining Vapor Retarder SA 106 and repeat the process. Roll Vapor Retarder SA 106 with a 100 lb (45 kg) steel roller to ensure full contact with the substrate.
- f. Align successive sheets with 3 in (7.6 cm) side laps and 6 in (15.2 cm) end laps. The seam area has a pre-applied primer/adhesive on one side for mating with the bottom of the next sheet. Remove the release poly from the seam area and mate the top sheet to the bottom. Roll the seam area to ensure constant contact.
- g. Hot air weld the end laps. Hot air welded laps must show a minimum ½ in (1.3 cm) bleed out. Stagger adjacent end laps a minimum of 12 in (30.5 cm).
- g. Apply Mastic to seal around penetrations. Use a trowel to mound the Mastic around the penetrations to seal the opening. Do not apply Mastic where it may come into direct contact with the membrane.

4. Vapor Retarder TA 138

- a. All Concrete surface must be clean, smooth, sound, dry, and free of loose materials, debris or contaminants such as water, moisture, frost, ice, oil and grease that would interfere with proper adhesion and compromise the performance of the product.
- b. Prepare concrete surfaces to achieve a Concrete Surface Profile CSP 3 to CSP 5 in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R-2013.
- c. Torch applied products should only be installed by trained personnel. It is imperative that the NRCA safety guidelines, as outlined in their Certified Roofing Torch Applicator Program (CERTA), and good industry practices be followed.
- d. Prime concrete surface with Vapor Retarder Primer TA. Concrete surfaces must be dry before installation. Shake or stir primer before applying. Let the primer dry

- completely.
- e. After the primer has dried completely, install Vapor Retarder TA 138 in a shingle fashion starting at the low point of the deck so the laps shed water.
- f. Chalk a line on the deck to align the first sheet. Unroll Vapor Retarder TA 138 and align the side lap with the chalk line. Back roll the sheet halfway. Begin torching the bottom side of Vapor Retarder TA 138. As the bitumen begins to soften pull the roll forward with a metal pole. When heated properly there should be a bleed out of approximately ½ in (1.3 cm). Back roll the other half of the roll and repeat the process.
- g. Kick out the next roll and align the side lap. Side laps must be a minimum of 3 in (7.6 cm). End laps should be a minimum of 6 in (15.2 cm). Stagger adjacent end laps a minimum of 12 in (30.5 cm). Cut the lower outside corner of the end lap at a 45 degree angle to minimize material build-up where it will be covered by the next roll.
- h. When heating the membrane move the torch in an 'L' pattern to ensure heating of the lap area on the bottom sheet. Proper heating will create a minimum ½ in (1.3 cm) bleed out. Walk in the seam area or use a weighted roller to ensure proper adhesion and bleed out. Ensure that all laps are firmly and smoothly adhered without wrinkles, voids or fishmouths.
- i. Check the seams with the edge of a trowel. Any loose areas should be lifted with the trowel, re-heated and pushed back down to achieve the necessary bleed out.
- j. Apply Mastic to seal around penetrations. Use a trowel to mound the Mastic around the penetrations to seal the opening. Do not apply Mastic where it may come into direct contact with the membrane.
- 5. Ply Sheet HA 87
 - a. All surfaces must be clean, smooth, sound, dry, and free of loose materials, debris or contaminants such as water, moisture, frost, ice, oil and grease that would interfere with proper adhesion and compromise the performance of the product.
 - b. Prior to installation, unroll Ply Sheet HA 87 onto the roof surface and allow it to relax. Place Ply Sheet HA 87 in desired position and back roll the product.
 - c. Torch applied products should only be installed by trained personnel. It is imperative that the NRCA safety guidelines, as outlined in their Certified Roofing Torch Applicator Program (CERTA), and good industry practices be followed.
 - d. Adhere Ply Sheet HA 87 to the substrate with Type III or Type IV asphalt according to the asphalt manufacturer's instructions and industry standards. Apply a full mopping of Type III or Type IV asphalt in accordance with manufacturer's instructions at a minimum rate of 25 lbs per 100 square feet (1.2 kg/m²). Install Ply Sheet HA 87 so that there are no significant and avoidable air spaces between the ply sheet and the substrate.
 - e. Overlap side laps 3 in (76 mm) and end laps 6 in (152 mm).
- 6. Ply Sheet TA 87
 - a. All surfaces must be clean, smooth, sound, dry, and free of loose materials, debris or contaminants such as water, moisture, frost, ice, oil and grease that would interfere with proper adhesion and compromise the performance of the product.
 - b. Application to structural concrete surfaces required priming with Vapor Retarder Primer TA. See Vapor Retarder Primer TA product data sheet for additional information.
 - c. Torch applied products should only be installed by trained personnel. It is imperative that the NRCA safety guidelines, as outlined in their Certified Roofing Torch Applicator Program (CERTA), and good industry practices be followed.
 - d. Chalk a line on the deck to align the first sheet. Unroll Ply Sheet TA 87 and allow the sheet to relax. Align the side lap with the chalk line. Back roll the sheet halfway.
 - e. Begin torching the bottom side of Ply Sheet TA 87. As the bitumen begins to soften pull the roll forward with a metal pole. When heated properly there should be a bleed out of approximately ½ in (1.3 cm). Back roll the other half of the roll and repeat the process.

- f. Kick out the next roll and align the side lap. Side laps must be a minimum of 3 in (7.6 cm). End laps should be a minimum of 6 in (15.2 cm). Stagger adjacent end laps a minimum of 12 in (30.5 cm). Cut the lower outside corner of the end lap at a 45 degree angle to minimize material build-up where it will be covered by the next roll.
- g. When heating the membrane move the torch in an 'L' pattern to ensure heating of the lap area on the bottom sheet. Proper heating will create a minimum ½ in (1.3 cm) bleed out. Walk in the seam area or use a weighted roller to ensure proper adhesion and bleed out. Ensure that all laps are firmly and smoothly adhered without wrinkles, voids or fishmouths.
- h. Check the seams with the edge of a trowel. Any loose areas should be lifted with the trowel, re-heated and pushed back down to achieve the necessary bleed out.

3.6. WOOD NAILER INSTALLATION

1. Install continuous code compliant wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Detail Drawings.
2. Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons per lineal meter) in any direction. Individual nailer lengths shall not be less than 3 feet (0.9 meter) long. Nailer fastener spacing shall be at 12 inches (0.3 m) on center or 16 inches (0.4 m) on center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches (0.15 m) of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall also meet the requirements of the current Factory Mutual Loss Prevention Data Sheet 1-49.
3. Thickness shall be as required to match substrate and insulation height to allow a smooth transition.
4. Any existing nailer woodwork which is to remain shall be firmly anchored in place to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons per lineal meter) in any direction and shall be free of rot, excess moisture or deterioration. Only woodwork shown to be reused in Detail Drawings shall be left in place. All other nailer woodwork shall be removed.
5. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any Sika Corporation product to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). When ACQ treated wood is used on steel roof decks or with metal edge detailing, a separation layer must be placed between the metal and ACQ treated wood.

3.7. INSULATION / ROOF BOARD INSTALLATION

General Criteria:

1. For Factory Mutual insured buildings polystyrene insulation may not be applied direct to steel deck.
2. Fasteners Insulation shall be installed according to insulation manufacturer's instructions.
3. Use Insulation shall be neatly cut to fit around penetrations and projections.
4. For Install tapered insulation in accordance with insulation manufacturer's shop drawings.
5. Insulation shall be installed according to insulation manufacturer's instructions.
6. Do not install more insulation board than can be covered with Sarnafil membrane by the end of the day or the onset of inclement weather.
7. Use at least 2 layers of insulation when the total insulation thickness exceeds 2-1/2 inches (64 mm). Stagger joints at least 12 inches (0.3 m) between layers.
 - a. Mechanical Attachment
 - i. Insulation shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to the insulation manufacturer's and Sika Corporation's recommendations for fastening rates and patterns. The quantity and locations of the fasteners and plates shall also cause the insulation boards to rest evenly on the roof deck/substrate so that there are no significant and avoidable air spaces between the boards and the substrate.

- Each insulation board shall be installed tightly against the adjacent boards on all sides.
- ii. Fasteners are to be installed consistently in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by the fastener manufacturer and Sika Corporation.
- iii. Use fastener tools with a depth locator and torque-limiting attachment as recommended or supplied by fastener manufacturer to ensure proper installation.
- b. Use fastener tools with a depth locator and torque-limiting attachment as recommended or supplied by fastener manufacturer to ensure proper installation.

3.8. SEPARATION LAYER INSTALLATION

Approved separation layer shall be installed directly over expanded or extruded polystyrene (unless supplied with a approved, compatible facer). Unfaced polystyrene is incompatible with Sarnafil membranes without a separation layer.

1. General Criteria

- a. Separation layer shall be installed according to Sika Corporation's instructions.
- b. Separation layer shall be neatly cut to fit around penetrations and projections.
- c. Do not install more separation layer than can be covered with Sarnafil membrane by the end of the day or the onset of inclement weather.
- d. Mechanical Attachment:
 - i. Separation layer shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to Sika Corporation's recommendations for fastening rates and patterns.
 - ii. Fasteners are to be installed in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by fastener manufacturer and Sika Corporation.
 - iii. Overlap separation layer edges 4 inches (100 mm) and fasten through the overlaps at 24 inches (0.6 m) on center using Sarnafasteners and Sarnaplates to hold in position. The installation of the separation layer is to be followed immediately by the installation of the S327 membrane.

3.9. SARNAFIL S327 MEMBRANE INSTALLATION

The surface of the insulation or substrate shall be inspected prior to installation of the Sarnafil roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

1. General

- a. Sarnafil S327 membrane shall be attached with Sarnafasteners and Sarndisc according to Sika Corporation's and wind uplift requirements per ASCE 7 or Factory Mutual.
- b. Membrane overlaps shall be shingled with the flow of water where possible.
- c. Sarnafil full-width rolls shall be fastened perpendicular to the direction of the steel deck flutes, wood plank, precast or cementitious wood fiber panel where possible.
- d. Tack welding of S327 full or half-width rolls for purposes of temporary restraint during installation is not permitted and may result in voiding of Sika Corporation warranty. Consult Sika Corporation's Technical Department for further information.

2. Perimeter and Corner Areas

- a. Over the properly installed and prepared substrate surface, S327 half-width rolls are to be installed either parallel or perpendicular to the entire perimeter edge according to FM guidelines. The number of adjacent half-rolls will be determined by building height and width and other conditions according to FM

guidelines and Sika Corporation Technical. Sarnafasteners and Sarnadiscs are installed along the edge of the membrane on the fastening line at a spacing determined by Sika Corporation and the Owner's Representative/Designer. Sarnadisc 2-3/8 inch is held back 5/8 inch (15.8 mm), Sarnadisc and Sarnadisc-XPN are held-back 1 inch (25 mm), and Sarnadisc MAXLoad are held-back 1-1/4 inch (31.8 mm) from the outer edge of the membrane. The adjacent half-roll is positioned to overlap the fastened edge of the first half-roll by 5-1/2 inches (140 mm) for Sarnadisc and Sarnadisc-XPN, and 7 inches (177.8 mm) for Sarnadisc-MAXLoad in accordance with the overlap lines marked on it's edge. The 5-1/2 inch (140 mm) overlap will allow the top membrane to extend 2-1/2 inches (63 mm) past the Sarnadisc and Sarnadisc-XPN for heat-welding. The 7 inch (177.8 mm) overlap will allow the top membrane to extend 2-1/4 inches (57.2 mm) past the Sarnadisc-MAXLoad for heat-welding. Fasteners shall clamp the S327 membrane tightly to the substrate. In corner areas where perimeter half-rolls intersect, add rows of Sarnafasteners and Sarnadiscs over the top the half-rolls and weld a (S327) coverstrip for watertightness. See Detail Drawings.

Notes:

- i. Perimeter area is defined as the outer boundary of the roof. If the roof is broken into different levels, each roof area shall be treated as an individual roof with its outer boundary being treated as a perimeter. Typically, internal expansion joints and firewalls are not considered to be full perimeters. Refer to Factory Mutual's Data Sheet 1-28 for more information.
 - ii. The ridge area is defined as the high point in the roof area formed by two intersecting planes. When the sum of the slopes is a minimum of 4 inches in 12 inches (30 degrees), each side of the ridge shall be treated as a perimeter area.
 - b. Hot-air weld overlaps according to Sika Corporation's requirements. Seam test cuts shall be taken at least 3 times per day.
3. Interior Area
 - a. Over the properly installed and prepared substrate surface, S327 full-width rolls are to be installed perpendicular to the steel deck flutes, wood plank or wood or concrete panels. Sarnafasteners and Sarnadiscs are installed along the edge of the membrane on the fastening line at a spacing determined by Sika Corporation and the Owner's Representative/Designer. Sarnadisc 2-3/8 inch is held back 5/8 inch (15.8 mm), Sarnadisc and Sarnadisc-XPN are held-back 1 inch (25 mm), and Sarnadisc-MAXLoad is held back 1-1/4 inch (31.8 mm) from the outer edge of the membrane. The adjacent full-roll is positioned to overlap the fastened edge of the first full-roll by 5-1/2 inches (140 mm) for Sarnadisc and Sarnadisc-XPN, and 7 inches (177.8 mm) for Sarnadisc-MAXLoad in accordance with the overlap lines marked on it's edge. The 5-1/2 inch (140 mm) overlap will allow the top membrane to extend 2-1/2 inches (63 mm) past the Sarnadisc and Sarnadisc-XPN for heat-welding. The 7 inch (177.8 mm) overlap will allow the top membrane to extend 2-1/4 inches (57.2 mm) past the Sarnadisc-MAXLoad for heat-welding. Fasteners shall clamp the S327 membrane tightly to the substrate. See Detail Drawings.
 - b. Hot-air weld overlaps according to Sika Corporation's recommendations. Seam test cuts shall be taken at least 3 times per day.
4. Securement Around Rooftop Penetrations
 - a. Around all perimeters, at the base of walls, drains, curbs, vent pipes, or any other roof penetrations, Sarnafasteners and Sarnadiscs shall be installed according to perimeter rate of attachment. Fasteners shall be installed according to the manufacturer's instructions. Fasteners shall be installed using the fastener manufacturer's recommended torque-sensitive fastening tools with depth locators. Fasteners shall clamp the Sarnafil membrane tightly to the substrate.
 - b. Sarnafil membrane flashings shall extend 2-1/2 inches (63 mm) past Sarnadisc and be hot-air welded to Sarnafil deck membrane.

3.10. HOT-AIR WELDING OF SEAM OVERLAPS

1. General
 - a. All seams shall be hot-air welded. All membrane to be welded shall be clean and dry.
 - b. All mechanics intending to use hot-air welding equipment shall have successfully completed a training course provided by a Sika Corporation Technical Service Representative prior to welding.
 - c. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.
 - d. Seam overlaps should be 3 inches (76 mm) wide when automatic machine-welding and 4 inches (100 mm) wide when hand-welding, except for certain details.
2. Hand-Welding
 - a. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
 - b. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow", the hand roller is positioned perpendicular to the nozzle and rolled lightly. For straight seams, the 1-1/2 inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch (20 mm) wide nozzle shall be used.
3. Machine Welding
 - a. Machine welded seams are achieved by the use of approved automatic welding equipment. When using this equipment, all instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated simultaneously off the generator.
 - b. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.
4. Quality Control of Welded Seams
 - a. The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator at locations as directed by the Owner's Representative or Sika Corporation's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.11. MEMBRANE FLASHING INSTALLATION

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Corporation. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

1. Sarnacol Adhesive for Membrane Flashings
 - a. Over the properly installed and prepared flashing substrate, Sarnacol adhesive shall be applied according to instructions found on the Product Data Sheet. The Sarnacol adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.
 - b. No adhesive shall be applied in seam areas that are to be welded. All panels of

- membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.
2. Install Sarnadiscs according to the Detail Drawings with approved Sarnafasteners into the structural deck at the base of parapets, walls and curbs. Sarnadiscs may be required by Sika Corporation at the base of all tapered edge strips and at transitions, peaks, and valleys according to Sika Corporation's details.
 3. Sika Corporation's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by Sika Corporation prior to installation.
 4. All flashings should extend a minimum of 8 inches (0.2 m) above roofing level, exceptions to this might be pipe boots and/or sealant pockets, etc. If in question, submit in writing to the Owner's Representative and Sika Corporation Technical Department for signed approval.
 5. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the Sarnafil membrane.
 6. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Sarnastop at 6-8 inches (0.15-0.20 m) on center.
 7. Sarnafil flashings shall be terminated according to Sika Corporation recommended details.
 8. All adhered flashings that exceed 30 inches (0.75 m) in height shall receive additional securement. Consult Sika Corporation Technical Department for securement methods.

3.12. LIQUID FLASHING SW or WW INSTALLATION

1. Surface Preparation
 - a. All surfaces should be clean, dry, free of dirt, dust, debris, loose particles, loose paint, rust and other contaminants.
 - b. Clean new roofing membrane with mineral spirits or all-purpose cleaner which will not remove the lacquer coating from the membrane. If the membrane is old or extremely soiled Sika Seam Cleaner should be used to restore the membrane to a 'like new' condition before applying Liquid Flashing.
 - c. Clean and prepare metal surfaces to near white metal in accordance with SSPC-SP3 (power tool clean). If power tools are not available, use abrasive paper with a grain size of 20 to 40 to remove all loose particles including paint flakes and rust.
 - d. Grind concrete and masonry surfaces with diamond cup wheel to remove laitance and contaminants.
 - e. Lightly sand glass, rigid PVC and plastic surfaces. Extend surface preparation a minimum of 1/8 in (3 mm) beyond the termination of the flashing.
 - f. Wipe metal and glass surfaces with Sika's Seam Cleaner and allow to dry.
 - g. For repairs or touch-up, wipe previously installed Liquid Flashing with Sika's Seam Cleaner to clean and reactivate the Liquid Flashing and allow to dry.
 - h. Prime wood and concrete surfaces with Liquid Flashing Primer. Allow Liquid Flashing Primer to cure completely before applying Liquid Flashing.
 - i. Apply painters tape to 'picture frame' and mask the outside edge of the detail. Place the tape 1/4 in (6.35 mm) beyond where the Liquid Flashing Fleece will terminate.
 - j. Pre-cut Liquid Flashing Fleece to fit around the penetration. Vertical flashing pieces must extend 2 in (51 mm) from the base and horizontal flashing pieces must extend 4 in (102 mm) out from the base. Flashing height should be a minimum of 8 in (203 mm) where possible.
2. Mixing Liquid Flashing SW

Thoroughly mix the entire container of Liquid Flashing SW with a slow-speed (200 to 400 rpm) mechanical mixer (electric drill with a mixing paddle) for two minutes.

Small Batch – 1 Liter

 - a. After mixing, pour 1 liter of Liquid Flashing SW into a clean plastic container.
 - b. Add 2 level tablespoons (20 g) of Liquid Flashing Catalyst to Liquid Flashing SW and mix with a slow-speed mechanical mixer for two minutes.
 - c. Using Liquid Flashing SW ambient temperature must be between 59°F (15°C) and 104°F (40°C) when mixing.

- d. Once mixed, the pot life is approximately 10 - 15 minutes depending on the ambient and surface temperature.
- Full Batch – 10 L Pail
- e. After mixing, add 2.5 packets (250 g) of Liquid Flashing Catalyst to Liquid Flashing SW and mix with a slow-speed mechanical mixer for two minutes.
 - f. Using Liquid Flashing SW ambient temperature must be between 59°F (15°C) and 104°F (40°C) when mixing.
 - g. Once mixed, the pot life is approximately 5 -10 minutes depending on the ambient and surface temperature.

3. ~~Mixing Liquid Flashing WW~~

~~Thoroughly mix the entire container of Liquid Flashing WW with a slow speed (200 to 400 rpm) mechanical mixer (electric drill with a mixing paddle) for two minutes.~~

~~Small Batch – 1 Liter~~

- ~~a. After mixing, pour 1 liter of Liquid Flashing into a clean plastic container.~~
- ~~b. Add 4 level tablespoons (40 g) of Liquid Flashing Catalyst to Liquid Flashing WW and mix with a slow speed mechanical mixer for two minutes.~~
- ~~c. Using Liquid Flashing WW ambient temperature must be between 23°F (- 5°C) and 68°F (20°C) when mixing.~~
- ~~d. Once mixed, the pot life is approximately 10 - 15 minutes depending on the ambient and surface temperature. Full Batch – 10 L Pail~~
- ~~e. After mixing, add 5 packets (500 g) of Liquid Flashing Catalyst to Liquid Flashing WW and mix with a slow speed mechanical mixer for two minutes.~~
- ~~f. Using Liquid Flashing WW ambient temperature must be between 23°F (- 5°C) and 68°F (20°C) when mixing.~~
- ~~g. Once mixed, the pot life is approximately 5 -10 minutes depending on the ambient and surface temperature.~~

4. Application

- a. After mixing in the Liquid Flashing Catalyst, apply Liquid Flashing to the clean prepared surface using a small ½ in (13 mm) nap roller with rounded edges.
- b. Apply 55 mils (1.4 mm) of Liquid Flashing evenly onto the substrate and terminate onto the inside edge of the painters tape. Place the Liquid Flashing Fleece into the wet Liquid Flashing taking care to remove any air bubbles and wrinkles. Terminate the Liquid Flashing Fleece 1/4 in (6.35 mm) from the inside edge of the painters tape. Apply additional Liquid Flashing at overlaps between the fleece layers.
- c. Immediately apply 25 mils (0.6 mm) of additional Liquid Flashing to fully saturate the fleece. Extend Liquid Flashing onto the inside edge of the painters tape. Remove the painters tape immediately after the Liquid Flashing application.
- d. Complex and irregular shapes such as nuts, bolts, etc. may require an additional 25 mil (0.6 mm) thick application of Liquid Flashing to ensure full coverage. Wait one hour before applying the additional coat.

3.13. METAL FLASHING INSTALLATION

- 1. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:
 - a. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
 - b. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.
 - c. Metal, other than that provided by Sika Corporation, is not covered under the Sika Corporation warranty.
 - d. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.
 - e. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.
 - f. Metal joints shall be watertight.
 - g. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch (25 mm).

- h. Airtight and continuous metal hook strips are required behind metal fascias. Hook strips are to be fastened 12 inches (0.3 m) on center into the wood nailer or masonry wall.
- i. Counter flashings shall overlap base flashings at least 4 inches (100 mm).
- j. Hook strips shall extend past wood nailers over wall surfaces by 1-1/2 inch (38 mm) minimum and shall be securely sealed from air entry.

3.14. SARNACLAD METAL BASE FLASHINGS / EDGE METAL INSTALLATION

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Corporation. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

- 1. Sarnaclad metal flashings shall be formed and installed per the Detail Drawings.
 - a. All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches (100 mm) on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch (25 mm).
 - b. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- 2. Adjacent sheets of Sarnaclad shall be spaced 1/4 inch (6 mm) apart. The joint shall be covered with 2 inch (50 mm) wide aluminum tape. A 4 inch minimum (100 mm) wide strip of Sarnafil flashing membrane shall be hot-air welded over the joint.

3.15. EDGE METAL INSTALLATION

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Corporation. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

- 1. Edge Grip Fascia
 - a. Position the roof membrane over edge of roof and down outside face of wall covering wood nailer(s) completely. Allow 1/2 inch (13 mm) of excess membrane to extend down past the wood nailer. Hot-air weld all seams making sure there are no voids in welds.
 - b. Apply a 3/8 inch (10 mm) continuous bead of Sikaflex – 1a sealant to the clean bottom of formed retainer. Install formed retainer from right to left as seen from rooftop. Overlap joints of straight run sections a minimum of 1 inch (25 mm) and corner sections a minimum of 5 inches (127 mm). Field cut sections as necessary.
 - c. Fasten formed retainer into side of nailer 12 inches (0.3 m) on center. Use fasteners provided with Edge Grip system; 1-1/2 inch (38 mm) hex head stainless steel fasteners with neoprene washers.
 - d. Fasteners shall provide a minimum 240 lbs. (109 kg) pull-out resistance; suitable for the substrates to which being installed.
 - e. Install concealed joint splice plates intersecting sections of snap-on fascia cover joints.
 - f. Position snap-on fascia cover so that it's top engages the formed retainer top. Rotate downward engaging bottoms of snap-on fascia cover and formed retainer. Allow 1/4 inch (6 mm) gap between snap-on fascia sections for thermal expansion. Field cut where necessary.
- 2. Edge Grip Extruded Fascia
 - a. Position the roof membrane over edge of roof and down outside face of wall covering wood nailer(s) completely. Allow 1/2 inch (13 mm) of excess membrane to extend down past the wood nailer. Hot-air weld all seams making sure there are no voids in welds.
 - b. Apply a 3/8 inch (10 mm) continuous bead of Sikaflex – 1a sealant to the clean

- bottom of heavy-duty extruded retainer. Install extruded retainer from right to left as seen from rooftop. Field cut sections as necessary.
- c. Install retainer splice under intersecting sections of extruded retainer.
- d. Fasten extruded retainer into side of nailer 12 inches (0.3 m) on center. Use fasteners provided with Edge Grip Extruded system; 1-1/2 inch (38 mm) hex head stainless steel fasteners with neoprene washers. Allow 1/8 inch (3 mm) gap between extruded retainer sections for thermal expansion [1/4 inch (6 mm) if temperature is below 40 degrees F (4 C)].
- e. Fasteners shall provide a minimum 240 lbs. (109 kg) pull-out resistance; suitable for the substrates to which being installed.
- f. Install concealed joint splice plates at intersecting sections of snap-on fascia cover joints.
- g. Position snap-on fascia cover so that it's top engages the extruded retainer top. Rotate downward engaging bottoms of snap-on fascia cover and extruded retainer base plate. Allow 1/4 inch (6 mm) gap between snap-on fascia sections for thermal expansion. Field cut where necessary.

3.16. WALKWAY INSTALLATION

1. Sarnatred-V
Roofing membrane to receive Sarnatred-V shall be clean and dry. Place chalk lines on deck sheet to indicate location of Sarnatred-V. Apply a continuous coat of Sarnacol 2170 or 2170 VC adhesive to the deck sheet and the back of Sarnatred-V in accordance with Sika Corporation's technical requirements and press Sarnatred-V into place with a minimum 100 lb (45 kg) steel, membrane roller, by rolling in two directions. Clean the deck membrane in areas to be welded. Hot-air weld the entire perimeter of the Sarnatred-V to the Sarnafil deck sheet. Check all welds with a rounded screwdriver. Re-weld any inconsistencies. **Important:** Check all existing membrane seams which are to be covered by Sarnatred-V with a rounded screwdriver and reweld any inconsistencies before installation. Do not run Sarnatred-V over Sarnabars.
2. Crossgrip XTRA
Crossgrip XTRA is installed loose laid on top of completed Sarnafil membrane roof assemblies. Unroll and position Crossgrip XTRA within specified areas and cut to desired length. Connecting clips are available for butting two ends together. **Important:** Check all existing membrane seams which are to be covered by Crossgrip XTRA with a rounded screwdriver and reweld any inconsistencies before installation. Do not run Crossgrip XTRA over Sarnabars.
3. Concrete Pavers
Using a separate piece of Sarnafil membrane as a protection layer, weld all edges in place. Place normal weight concrete pavers on the protection membrane. In areas of high wind exposure the pavers shall be strapped together with stainless steel metal straps that are flush with the paver surface. **Important:** Check all existing membrane seams which are to be covered by concrete pavers with a rounded screwdriver and reweld any inconsistencies before installation. Do not run concrete pavers over Sarnabars.

3.17. PERIMETER WARNING INSTALLATION

1. Tape / Membrane
Areas of membrane where to be applied must be cleaned to a "like new" condition. Failure to properly clean the membrane will result in less than satisfactory adhesion or welding. The membrane should be cleaned as follows:
 - a. New membrane: Remove loose dirt and dust by wiping clean with water. For areas where dirt is embedded, scrub the application area with a commercial cleaner such as Simple Green, 409 or other similar all-purpose cleaner using a Scotch Brite scrubbing pad or similar product. Wash away residual cleaning material with clean water.

- b. Weathered membrane: For older membranes or areas where there is excessive dirt buildup, use the above cleaning procedure followed by cleaning with a natural fiber rag wet with Seam Cleaner, and wipe away all residual cleaning solution and remaining dirt until membrane has a "like new" appearance.
- 2. After surface is clean and dry, apply:
 - a. Tape: Apply tape to membrane taking care to avoid trapping air and creating blisters as tape is smoothed over with hand pressure. If a chalk line is used, be sure to keep chalk dust clear of application area. Do not apply Perimeter Warning Tape to surfaces where the temperature is below 40°F (4°C).
 - b. Membrane: Perimeter Warning Membrane is hot-air welded to the top of PVC roofing membrane in the areas required.
 - c. Perimeter Warning Tape or Membrane may be slippery when wet.

3.18. TEMPORARY CUT-OFF

All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100 percent watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. Waterstop shall be sealed to the deck and substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as described in Section 2.10. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of off site. None of these materials shall be used in the new work.

If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.19. COMPLETION

and Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of Sika Corporation shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and Sika Corporation prior to demobilization.

All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

3.20. DETAILS

Refer to Typical System Details section or usa.sarnafil.sika.com.

END OF SECTION 07 54 19

**SECTION 07 60 00
FLASHING AND SHEET METAL**

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE:

- A. Joint Sealants: Section 07 92 00
- B. Painting: Sections 09 91 13 & 09 91 23

1.2 QUALITY ASSURANCE:

- A. Requirements of Regulatory Agencies: Conform to the requirements of SMACNA.

1.3 GUARANTEE:

- A. Guarantee materials and workmanship for two (2) years.

1.4 SUBMITTALS

- A. The contractor shall submit flashing and sheet metal shop drawings for review. Refer to Section 01 34 00 for additional submittal requirements.

PART 2 - PRODUCTS

2.1 SHEET METAL:

- A. Aluminum: ASTM B209, alloy 3003, temper H14.
Finish: AA-CC22A41.
Minimum thickness: 0.032".
- B. Galvanized Steel: ASTM A526, commercial quality
Coating Designation: G90, ASTM A 525.
Minimum thickness or gage: 0.0217".

2.2 FASTENERS:

- A. Nails: Galvanized steel material, flathead, wire, barbed, slating type, FS FF-N-105B.
- B. Screws: Self-tapping sheet metal type, FS FF-S-107C.
- C. Exposed Screws: Self-tapping screws with neoprene coated stainless steel washers.

2.3 EXPANSION ANCHORS: FS FF-B-588.

2.4 SOLDER: Aluminum manufacturer's standard.

2.5 SEALANT: One part polysulfide, silicone or polyurethane type, manufacturer's standard.

2.6 BITUMINOUS PLASTIC CEMENT: FS SS-C-153B, Type I.

2.7 PRIMER COATING: FS TT-P-641F, Type I.

2.8 PAINTING: Paint all sides of all flashing and sheet metal per specification Section 09 91 13.

2.9 FABRICATION:

- A. Cleats: Minimum width 2".

Same material and thickness as sheet metal.

- B. Reglets: Same material and thickness as sheet metal.
Shop formed corners and joint connectors.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Verify that substrates are smooth and clean to extent needed for sheet metal work.
- B. Verify that reglets, nails, cants and blocking to receive sheet metal are installed and are free of concrete and soil.
- C. Do not start sheet metal work until conditions are satisfactory.

3.2 PREPARATION:

- A. Before installing sheet metal, verify shapes and dimensions of surface to be covered.
- B. Refer to appendix 1, for the treatment of historic materials, for additional requirements for all building exterior work.

3.3 INSTALLATION:

- A. General. Install work watertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
- B. Hem exposed edges.
- C. Angle bottom edges of exposed vertical surfaces to form drips.
- D. Seams. Common lock seams: 5/8" finished width. Four ply loose lock.
- E. Flat Lock Seams: 3/4" finished width. Four-ply flat lock, maletted tight. Sweated full with solder.
- F. Cover Plate seams: Space abutting sheets 1/2" apart, plus fastener thickness. Cover joint with 4" wide back-up and cover plate set in sealant. Match plates to flashing profile. Secure to substrate with screws installed through open space between flashing sheets.
- G. Cleats. Spaced Cleats: 2' o.c. Secure to substrate with fasteners and cover heads with cleat tabs.
- H. Continuous Cleats: Secure to substrate with fasteners spaced 1' o.c.
- I. Reglets: Install in accurate locations, straight, in-line and with leak-proof joints.
- J. Soldering: Clean and flux metals prior to soldering. Sweat solder completely through seam width.
- K. Sealant Installation: Apply 1/4" diameter bead, centered on full length of joint.
- L. Bituminous Plastic Cement: Trowel 1/8" thick.
- M. Painting: Apply asphalt coating compound to each contacting metal face of dissimilar metals. Paint all sides of all flashing and sheet metal per specification Section 09 91 13.

- N. Roof Counterflashing: Overlap base flashing 4" minimum. Install bottom edge tight against base flashing. Lap seam vertical joints 3" minimum and apply sealant. Miter, lap seam and close corner joints with solder or sealant.
- O. Roof Penetration Flashing: Base flashing. Extend flange onto roof 6" minimum away from penetration. Extend flange upward around penetration to at least 8" above roofing felts. Fold back upper and side roof flange edges 1/2" minimum. Solder-lap joints.
- P. Counterflashing. Overlap base flashing 1" minimum with storm collar sloped away from penetration. Secure to penetration with draw band and sealant.
- Q. Equipment Support Flashing: Fully cap support. Overlap base flashing 4". Solder-lap joint. Provide sealant around penetration through flashing.

3.4 REPAIRING:

- A. Repair or replace damaged work.

3.5 CLEANING:

- A. As work progresses, neutralize excess flux with 5% to 10% washing soda solution and thoroughly rinse.
- B. Leave work clean and free of stains, scrap and debris.

END OF SECTION 07 60 00

**SECTION 07 63 00
FABRICATED GUTTERS AND DOWNSPOUTS**

PART I-GENERAL**1.01 Work Included:**

Steel gutters and downspouts at eaves with painted finish complete with required connecting pieces and anchorages.

Steel leader boxes and downspouts at flat roof areas with painted finish complete with required connecting pieces and anchorages.

Precast concrete splash pads.

1.02 Related Work:

Section 07 60 00 - Flashing and Sheet Metal
Section 09 91 13 – Exterior Painting

1.03 References:

ASTM A527: Steel sheet, zinc coated by the hot dip process, lock forming quality.

SMACNA: Architectural Sheet Metal Manual.

1.04 Shop Drawings:

Submit six sets of shop drawings for gutters and downspouts in accordance with Division One. Clearly indicate general construction, configurations, jointing methods and locations, fastening methods and locations and installation details.

1.05 Warranty:

Provide Owner with guarantee stating that gutters and downspouts will properly shed water, transport water away from roof, and protect felts from physical damages for a minimum period of two years from date of acceptance by Owner, as certified by Architect, and that damage resulting from failure to provide above stated performances will be repaired to the satisfaction of Owner at no additional cost.

PART II-PRODUCTS**2.01 Materials and Components:**

Gutters, leader boxes and downspouts: 24 gauge galvanized steel sheet. Refer to the construction drawings for gutter & leader box profiles & downspout sizes. All gutters, leader boxes, and downspout sizes & profiles are to match existing conditions unless specified otherwise on the drawings.

Bituminous paint: Acid and alkali resistant type; black color.

Anchorage devices: Type recommended by manufacturer, SMACNA and acceptable to the Architect.

Expansion joints: At intervals and as recommended by SMACNA and acceptable to the Architect.

Splash pads: Precast concrete type, of sizes and profiles indicated on drawings; minimum 3000 psi at 28 days, with minimum 5 per cent air entrainment.

Provide screens and downspouts.

2.02 Fabrication:

Form gutters and downspouts of profiles and sizes indicated on drawings and as required to properly collect and remove water. Fabricate complete with required connection pieces, expansion joints per SMACNA recommendations, as indicated on drawings.

Form sections square, true and accurate in size, in maximum possible lengths and free of distortions and defects detrimental to appearance or performance. Hem exposed edges. Allow for expansion at joints.

Slope gutters to drain to downspouts.

2.03 Painting:

All gutters and downspouts and associated flashings and connections shall be full primed and painted on all sides per Specification Section 09 91 13 – Exterior Painting

PART III-EXECUTION

3.01 Installation:

Install gutters and downspouts. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

Apply bituminous paint on surfaces to be in contact with dissimilar materials.

Slope gutters to downspouts.

Set splash pads under all downspouts.

END OF SECTION 07 63 00

**SECTION 07 92 00
JOINT SEALANTS****PART 1 - GENERAL****1.1 SCOPE:**

- A. This section contains general specifications pertaining to all weather-sealing and caulking throughout the project and becomes a part of all sections containing reference hereto, or where materials of the types specified in this section are required by the drawings.

1.2 GENERAL REQUIREMENTS:

- A. Guarantee. Provide written guarantee for all calking and sealants against all defects of material or application for a period of two years after date of acceptance. All failures that may occur within this period due to defective application or materials shall, upon written notification of such failure, be repaired or replaced with proper materials and labor as approved by the Architect, at no additional cost to the City.
- B. Submit six samples of various types (and colors where applicable) of materials specified, prior to delivery of materials to the job.
- C. Deliver materials to the job in original unopened containers bearing manufacturer's name, product designation and date of manufacture.
- D. Install proprietary materials specified in compliance with manufacturer's instructions. Send copies of manufacturer's instructions at least two (2) weeks before installation.

PART 2 - MATERIALS**2.1 MATERIALS:**

- A. Use sealants of the following types and manufacture. Unless specified or directed otherwise, use materials to match color of adjacent materials. Where adjacent materials on each side of the joint are different colors, the Landscape Architect will select sealant colors. If the desired color is not available from one manufacturer, select proper color from another manufacturer. Use those sealants from the following list as appropriate for the application, per manufacturer's recommendations.

2.2 INCIDENTAL MATERIALS:

- A. Staining Characteristics. All joint filler, primers, or other materials used in conjunction with sealant shall be of such composition as to not cause staining of the sealant or the materials to which they are applied.
- B. Compressible Joint Filler. Closed cell neoprene, plastic foam, or urethane, as recommended by the sealant manufacturer for use in conjunction with the sealant.
- C. Primers. As recommended by the sealant manufacturer for uses in conjunction with the sealant for application onto the various types of materials to which the sealer is applied.
- D. Cleaners, where required in lieu of primers. As recommended by the sealant manufacturer.

2.3 MATERIAL TYPES:

- A. Type #1 - One-part polysulfide, FS TT-S-00230C.

1. Elastoseal #230 by Pacific Polymers, 15081 Moran Street, Unit E, Westminster, California.
 2. Uniparmastic by Parr, Inc., distributed by C.R. Laurence Co., 720 Mateo Street, Los Angeles, California.
 3. PTI 747, by Protective Treatments of Dayton, Ohio.
- B. Type #2 - Two-part polysulfide, FS TT-S-00227E.
1. Elastoseal #227 by Pacific Polymers, 15081 Moran Street, Unit E, Westminster, California.
 2. Parmastic by Parr, Inc., distributed by C.R. Laurence Co., 720 Mateo Street, Los Angeles, California.
 3. PTI 748, by Protective Treatments of Dayton, Ohio.
- C. Type #3 - One-part silicone sealant, FS TT-S-1543.
1. General Electric 1200 non-paintable, distributed by C.R. Laurence Co., 720 Mateo Street, Los Angeles, California.
 2. Dow Corning 780 and 781, Dow Chemical, Midland, Michigan.
- D. Type #4 - Two-part silicone.
1. General Electric 1600, distributed by C.R. Laurence Co., 720 Mateo Street, Los Angeles, California.
- E. Type #5 - Multi-part urethane sealant, FS TT-S-00227E, non-sag or pourable consistency, non-staining.
1. Elastothane 227 by Pacific Polymers, 15081 Moran Street, Unit E, Westminster, California 92683.
 2. PRC 270 by Products Research, 2900 Empire Street, Burbank, California.
- F. Type #6 - Latex acrylic calk for drywall and interior calking.
1. Parr Latex Calk by Parr, Inc., distributed by C.R. Laurence Co., 720 Mateo Street, Los Angeles, California.
 2. Elastoseal Latex by Pacific Polymers, 15081 Moran Street, Unit E, Westminster, California 92683.

PART 3 - APPLICATION

- 3.1 Joint Filler. Accurately position within the joint to establish and control the uniform designated thickness of sealant.
- 3.2 Apply material with sufficient pressure to completely fill the void space and to assure complete wetting of contact area to obtain uniform adhesion. During application, keep tip of nozzle at bottom of joint, forcing sealant to fill from bottom to top. Finish joints smooth and flush with adjacent surface unless detailed to be finished below the surface.
- 3.3. Perform joint preparation, including cleaning and priming, in accordance with manufacturer's instructions.
- 3.4 Provide manufacturer's inspection of conditions prior to start of the work and initial supervision at the start of each application, in order to insure that any physical conditions which would result in defective work are properly corrected before materials are applied, that properly instructed personnel are available to do the work, and that proper procedures are being followed. Provide such inspection and supervision by qualified personnel. Report all unsatisfactory conditions

existing at the time of inspection in writing to the Architect for correction before proceeding with the work.

- 3.5 Notify the manufacturer at least 72 hours prior to the time inspection if required.
- 3.6 Failure or refusal of the manufacturer to provide the inspection and supervision as required hereunder constitutes grounds for non-acceptability of materials manufactured by him even though such materials have been specified or approved.

END OF SECTION 07 92 00

**SECTION 08 11 00
METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hollow Metal Doors and Frames.

B. Related Sections:

1. Section 08 71 00 Finish Hardware.
2. Section 09 91 13 & 09 91 23 Exterior & Interior Painting.

1.2 REFERENCES

- A. ASTM E152, Fire Tests of Door Assemblies.
- B. ASTM A525, specification for Steel Sheet, Zinc Coated.
- C. ANSI/SDI 100, Recommended Specifications for Standard Steel Doors and Frames.
- D. ANSI/SDI 119, Performance test Procedures for Steel Door Frames and Anchors.
- E. NFPA 80, Standard for Fire Doors and Windows.
- F. NFPA 101, Life Safety Code.
- G. ANSI A151.1, Test Procedure and Acceptance Criteria for Physical Endurance, Steel Doors and Frames.
- H. ANSI A224.1, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- I. SDI 107, Hardware on Steel Doors, Reinforcement Application.
- J. Applicable model building code.
- K. California Title 24.
- L. UBC 7-2, Fire Tests of Door Assemblies.
- M. UBC 7-4, Fire Tests of Window Assemblies.

1.3 SUBSTITUTIONS & SUBMITTALS

- A. Shop Drawings: Submit six copies. Indicate door and frame elevations, sections, materials, gauges, finish, fabrication/erection details, locations of hardware and vision lites and louvers.
- B. Certification of Compliance: Provide letter of certification that all materials comply with these Specifications.

- C. Samples: Submit as requested by Architect. Samples shall be returned after review.
- D. Substitutions: Make substitution requests in accordance with Division 1. Architect reserves the right to access an hourly fee to review and evaluate substitutions.

1.4 QUALITY ASSURANCE

- A. Steel Door and Frame Supplier: direct factory supplier who employs a Certified Door Consultant (CDC) or person with equivalent experience, available at reasonable times during course of Work, for consultation to Owner, Architect and Contractor.
- B. Label Construction: A physical label or approved marking shall be affixed to the fire door or fire door frame at an authorized facility as evidence of compliance with procedures of the labeling agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: coordinate delivery to the appropriate locations (shop or field) for installation.
- B. Storage of Doors: Doors shall be stored in an upright position under cover. Place the units on at least 4" (101.6 mm) wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create a humidity chamber and promote rusting. If the corrugated wrapper on the door becomes wet, or moisture appears, remove the wrapper immediately. Provide a 1/4" (6.35 mm) space between the doors to promote air circulation.
- C. Storage of Frames: Frames shall be stored under cover on 4" (101.6 mm) wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. Assembled frames shall be stored in a vertical position, five units maximum in a stack. Provide a 1/4" (6.35 mm) space between frames to promote air circulation.
- D. Inspect delivered items for damage. Minor damage may be repaired provided repaired items are equal to new Work and accepted by the Architect. Provide new items when directed. Comply with VOC regulations when repairing damage.

1.6 SEQUENCING AND SCHEDULING

- A. Deliver doors and frames to the jobsite in a timely manner so not to delay progress of other trades.
- B. Issue purchase orders to suppliers so as not to interfere with normal quoted delivery times.

1.7 WARRANTY

- A. Steel doors and frames supplied with a one (1) year warranty against defects in materials and workmanship.

1.8 ENVIRONMENTAL

- A. Packaging and Disposal: package in biodegradable packs, paper or cardboard boxes. Dispose of non-biodegradable packs, plastic, styrofoam, polystyrene, and polyurethane to a licensed or authorized collector for proper disposal. Comply with the applicable standards and laws for VOC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Steelcraft Manufacturing Co., Cincinnati, Ohio
- B. Curries Co., Mason City, Iowa
- C. Ceco Corp., Oakbrook, Illinois

2.2 MATERIALS

- A. Steel requirements: Doors and frames manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM A366 and A568 general requirements. Galvanized doors and frames at exterior locations to A60 minimum coating weight. Stainless steel doors manufactured with Type 304, dull finish. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM A569.
- B. Coating Materials:
 - 1. Primer: Manufacturer's standard rust inhibiting primer to ANSI A224.1.
- C. Core Materials:
 - 1. Doors: Non-toxic honeycomb or vertical steel stiffened internal reinforcing manufactured of hot rolled, pickled and oiled steel per ASTM A569. Exterior doors shall be insulated.
 - 2. Fire labeled doors with temperature rise rating: Mineral fiber core, temperature rating per code.
- D. Glass Light Frames: Flush with door face, fabricated of 18 ga. steel.

2.3 FABRICATION

- A. Doors:
 - 1. Classification: SDI.
 - a. Exterior Doors:

<u>GRADE</u>	<u>MODEL</u>	<u>GAUGE</u>	<u>DESCRIPTION</u>	<u>CYCLES</u>
III		1	14	Extra Heavy Duty, Full Flush 5,000,000

- b. Interior Doors:

<u>GRADE</u>	<u>MODEL</u>	<u>GAUGE</u>	<u>DESCRIPTION</u>	<u>CYCLES</u>
II		1	16	Heavy Duty, Full Flush 5,000,000
	2.		Vertical lock edges: <ul style="list-style-type: none">a. Beveled 1/8 inch in 2 inches.b. Exterior, seamless construction by tack welding and fill.c. Interior, manufacturers standard interlocking and glued edge.	
	3.		Top and bottom channels: <ul style="list-style-type: none">a. Not less than 14 gauge, flush or inverted.	

- b. Welded to the face sheets.
 - c. Exterior doors: flush steel top channel.
 - 4. Astragals: Flat security type or Z type per details.
- B. Frames:
 - 1. Construction:
 - a. 14 gauge cold rolled steel at interior locations; 12 gauge galvanized at exterior locations.
 - b. 12 gauge, full width, face and head reinforcement for non-labeled openings over 48" in width.
 - 2. Corner Construction: Weld full depth and face; grind smooth and re-prime. Weld includes faces, rabbets, soffit, and stops.
 - 3. Provide temporary shipping spreaders to help protect frames from damage during transit and handling. Remove spreaders prior to setting frame.
- C. Frame Anchors:
 - 1. Attachment to Masonry Construction:
 - a. Galvanized.
 - b. Adjustable, flat, corrugated, or perforated T shaped with leg not less than 2 inches wide by 10 inches long, or wire type, not less than 3/16 inches in diameter.
 - 2. Attachment to Drywall Construction:
 - a. Steel or Wood Stud type to accommodate frame jamb depth and face dimension on welded type frame.
 - 3. Provide one anchor for every 30 inches of jamb or fraction thereof.
 - 4. Floor Anchor: Angle clip type.
 - a. 16 Gauge.
 - b. Two fasteners per jamb.
 - c. Weld to bottom of each jamb.
 - 5. Existing Masonry or Concrete:
 - a. 3/8 inch countersunk flat head bolt and expansion shields.
 - b. Locate 6 inches from top and bottom and maximum 24 inches on center.
 - c. Weld pipe spacers or other type of spacers, per manufacturer's standard design, in back of frame soffit.
 - 6. Head Struts: Per details.
- D. Preparation for Hardware:
 - 1. Reinforce per SDI 107.
 - 2. Lock and Closer reinforcement: box type.
 - 3. Door Hinge reinforcement: 7 gauge or equivalent, manufacturer's standard.
 - 4. Punch strike jambs to receive three silencers; double leaf frames to receive manufacturer's standard preparation.
 - 5. Hardware locations per "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames".
 - 6. Provide welded in place guards for all hardware cutouts in frame.
 - 7. Electrical preps: provide welded-in-place boxes, special designed anchors, raceways and access panels as required.

PART 3 - EXECUTION

3.1 SETTING FRAMES

- A. Set frames in accordance with SDI 105.
- B. Set welded frames in place prior to construction of adjacent partition work. Properly brace frame until permanent anchors are set.
- C. Install frames plumb and true with only hairline seam at corner joints.
- D. Install fire rated frames in accordance with NFPA 80.

3.2 DOOR INSTALLATION

- A. Clearances:
 - 1. 1/8 inch between door and frame at head and jambs.
 - 2. 1/8 inch at meeting edges of pairs.
 - 3. 1/8 inch at transom panels, without transom bar.
 - 4. 3/4 inch above finish floor at sills without threshold.
 - 5. 1/4 inch at sill with threshold.
 - 6.

3.3 ADJUSTMENT AND CLEANING

- A. Remove dirt and excess sealants, mortar, or glazing compounds from exposed surfaces.
- B. Adjust moving parts for smooth operation. Use shims as required.
- C. Fill dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces. Paint to match adjacent surface.

END OF SECTION 08 11 00

SECTION 08 12 00
METAL FRAMES

PART I GENERAL

1.01 SUMMARY:

- A. Description: This section includes Steel Doors, Frames, Sidelites, Transom and Window Frames where shown on the drawings and as specified herein.
- B. Related work not included in this section:
 - 1. Builders finish hardware including gaskets and weather-stripping.
 - 2. Glass and glazing.
 - 3. Sealant and caulking at joints

1.02 QUALITY ASSURANCE:

- A. Applicable standards of the following as referenced herein:
 - 1. AAMA, American Architectural Manufacturers Association
 - 2. ANSI, American National Standards Institute
 - 3. ASTM, American Society for Testing and Materials
 - 4. ADA, Americans with Disabilities Act
 - 5. NFPA 80, National Fire Protection Association
 - 6. NAAMM/HMMA, National Association of Architectural Metals Manufacturers
 - 7. UL 10C, Standards for Positive Fire Tests of Door Assemblies.
- B. Manufacturer shall have been regularly engaged in manufacturing steel door, frames and window assemblies for a period of ten years. Doors and frames shall be fabricated by a single manufacturer. The manufacturer must have an effective quality control system in place.
- C. Provide current test reports to substantiate that all products have been tested to meet the following criteria.
 - 1. Fire Labeled doors and frames, ASTM E2074, UBC 7.2, UL 10C
 - 2. Performance test, ANSI A250.4
 - 3. Wind Load, Deflection / ASTM E330, Air Infiltration / ASTM E283, Water Penetration/ASTM E331
- D. Allowable Tolerances as stated in NAAMM/HMMA Technical Manual.

1.03 SUBMITTALS:

Submittal Drawings: Show door and frame elevations and sections. Show listing of opening descriptions including locations, gages, and anchors. Show location and details of all openings. Include test reports on the following: Cycle test, Air and Water Infiltration.

1.04 WARRANTY:

All hollow metal work shall be warranted from defects in workmanship and quality for a period of three (3) years from shipment.

PART II PRODUCTS

2.01 DOORS

- A. The Steel Doors are based on Stiles Custom Metal, Inc. ([see www.stilesdoor.com](http://www.stilesdoor.com)) and shall be of the types and sizes shown on the approved submittal drawings and shall be constructed in accordance with the specifications.

1. Vertical Edges: Face sheets shall be joined at center of vertical edges and continuously welded full height of the door with no visible seams on their faces or vertical edges. Welds shall be finished smooth. Single acting doors - beveled 1/8" in 2" profile. At exterior pair openings the meeting stiles shall be furnished with the Air-Tek™, continuous, integral pile weather strip. Adhesive or screw applied weather strip shall not be accepted.
2. Integral Astragal: Where required astragals shall be formed as an integral part of the door skin with corresponding recessed area formed into adjacent door. Surface mounted flat plate or Z shaped astragals shall not be accepted.
3. Door thickness shall be 1-3/4". Doors shall be neat in appearance and free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the gage of metal used.
4. Materials: Doors shall be made of commercial quality, cold-rolled steel per ASTM A1008 / A1008M.
 - a. Interior doors: Face sheets shall be 0.042 in. (18 gage) min. thickness cold rolled steel.
 - b. Exterior doors: Face sheets shall be 0.053 in. (16 gage) min. thickness with zinc coating A 60.
5. Door Core Model Options: (choose one) ([see www.stilesdoor.com](http://www.stilesdoor.com))

[Steel Stiffened]: 22 gage min., continuous, vertical, formed steel sections spanning the full thickness of the interior space between door faces. Stiffeners spaced so that the vertical interior webs shall be no more than 6" apart. Spot welded maximum of 4" o.c. vertically. Spot welds shall be sanded smooth to eliminate spot weld marks as much as possible. Spaces between stiffeners shall be filled with: (choose one) [Fiberglass Batt Insulation] or [Recycled Cotton Batt Insulation].

[Honeycomb]: "Kraft" paper, hexagonal cell, fully faced on both sides. Open cell un-faced honeycomb shall not be acceptable. Core and inside of door skins shall be completely covered with contact adhesive achieving 100% bond.

[Temperature Rise Core]: Dense Mineral Core rated (choose one) [250° F / 121° C] or [450° F / 232° C] and shall be laminated to the inside of the door skins with contact adhesive achieving 100% bond.

[Polyurethane Core]: Rigid, cellular type, board conforming to ASTM D1622, 1.8 pounds per cubic foot density min., containing no urea formaldehyde resins. Option: [Polyisocyanurate], 2.0 pounds per cubic foot density min., containing no urea formaldehyde resins. Core shall be laminated to the inside of the door skins with contact adhesive achieving 100% bond.

[Polystyrene Door Core]: Rigid, extruded, closed cell board, 1 pound per cubic foot density min., conforming to ASATM C578, Type 1. Core shall be laminated to the inside of the door skins with contact adhesive achieving 100% bond.

6. The top and bottom edges shall be closed with a continuous channel, 16 gage minimum, spot welded to both face sheets maximum 4" o.c. Top of exterior doors shall be fitted with an additional flush closing channel and

- sealed water-tight.
7. Door opening tag number shall be permanently engraved into the center hinge reinforcement using a programmable engraver. The engraving shall be deep enough to be read after the hinge reinforcement bar is painted. The use of paper stickers only is not acceptable.
 8. Glass moldings and stops: Where specified, doors shall be provided with internal channel type, flush glass moldings, to secure glazing in accordance with glass sizes and thickness shown on approved submittal drawings. Molding channels minimum 18 gauge steel, securely spot welded, maximum 4" o.c., to the inside face of the door skin. Removable glass channel stops shall be minimum 18 gage, A60 galvanized steel, butted at corner joints, secured to the door with zinc plated #8 oval head, countersunk, sheet metal screws. Door lights that are cut out of the door after the door is built are not acceptable. Externally mounted lite kits that protrude from the door face are not acceptable.
 9. Louvers: Louvers shall be sight proof, with: (choose one) [embossed, security type kick proof] or [V or Y type] (see www.stilesdoor.com) blades, minimum 18 gage, secured to door with sheet metal screws. Louvers at exterior locations shall be A60 galvanized and be provided with Insect screens. Door skins at louver cutouts shall be reinforced with continuous channel reinforcement, full door thickness and perimeter, spot welded to door face 4" o.c.
 10. Finish: After fabrication, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth.

2.02 STEEL PANELS:

Steel panels shall be made of the same material and construction and finished in the same way as specified for doors.

2.03 FRAMES

- A. Provisions of this section are applicable to door frames, transom lites, sidelites and window assemblies.
1. Materials: Frames shall be constructed of 16 gage, 0.053 in. (1.3mm) minimum thickness. Exterior frames shall have an A60 zinc coating.
 2. Construction: Frames shall be welded units of the sizes and types shown on approved shop drawings. Knocked-down frames shall not be accepted. Jamb, header; mullion and sill profiles shall be in accordance with the frame schedule and as shown on the approved submittal drawings. Mitered corner joints shall have all contact edges closed tight with faces mitered and stops butted. Faces and soffits shall be continuously welded. The use of gussets or splice plates shall not be acceptable. All other joints shall have faces continuously welded. Faces shall be finished smooth. Mineral fillers are not permitted.
 3. Exterior windows: Window installer and glazier shall follow Stiles instructions to prevent air and water penetration.
 4. Exterior door frames shall have Seal-Tek™ integral weather-strip kerf provided. Adhesive or screw applied weather-strip shall not be accepted. (see www.stilesdoor.com)
 5. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designated for assembly in the field by installer. Field joints shall be made in accordance with approved submittal drawings and shall be field welded by installer.

2.04 FINISH HARDWARE:

Doors and frames shall be mortised, reinforced, drilled and tapped at the factory for completely templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted, anchor hinges, or non-template mortise hardware is to be applied, doors shall be reinforced, with all drilling and tapping done by others in the field. Reinforcement steel shall comply with NAAMM/HMMA 830 and 861.

2.05 FINISH:

Doors and frames shall be treated to insure maximum paint adhesion and shall be painted on all accessible surfaces with one coat of a rust inhibitive, modified Alkyd, Zinc compound, gray primer that meets or exceeds all ANSI A250.10-98 performance criteria. Primer coat shall be fully cured prior to shipment. Red or brown colored primers shall not be permitted.

PART III EXECUTION

3.01 CLEARANCES AND TOLERANCES

Shall be in compliance with NAAMM / HMMA standards.

3.02 SITE STORAGE AND PROTECTION OF MATERIALS

- A. Deliver and store materials to prevent damaging and marring finishes.
- B. Protection: Protect metal surfaces from contact with lime, mortar, cement, acids, and other harmful surfaces and from careless handling, storage or machining.

3.03 INSTALLATION:

- A. It shall be the responsibility of the installation contractor to perform the following:
- B. Installation and tolerances shall meet the requirements of HMMA 840 and as further specified here in. Prior to installation, all frames must be checked and corrected for size, swing, squareness, alignment, twist and plumbness.
- C. Any grout or other bonding material shall promptly be cleaned off of frames or doors following installation. Hollow metal surfaces shall be kept free of grout, tar, or other bonding material or sealer.
- D. Plaster guards and junction boxes are intended to protect hardware mortises and tapped mounting holes from masonry grout of 4" maximum slump consistency which is hand troweled in place. Grouting materials such as gypsum products which require air to dry (cure) shall not be used in any closed section, such as a mullion.
- E. Hardware must be applied in accordance with hardware manufacturer's templates and instructions.
- F. Primed or painted surfaces which have been scratched or otherwise marred during installation including field welding and/or cleaning shall be promptly finished smooth, cleaned, treated for maximum paint adhesion and touched up with a rust inhibitive primer.

End of Section 08 12 00

**SECTION 08 14 00
WOOD DOORS****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Interior standard wood veneer flush wood doors.
2. Interior painted flush wood doors.

B. Related Requirements:

1. Section 08 17 00: Prefinished Steel Frames.
2. Section 08 71 00: Door Hardware
3. Section 08 80 00: Glass & Glazing
4. Sections 09 91 13 & 09 91 23: Exterior & Interior Painting

1.2 COORDINATION

- A. STC-Rated Doors: Where installed in hollow metal frames, fill frames with compressed mineral wool insulation.

1.3 REFERENCES

- A. It is the intent of the specification that all wood doors shall comply with the standards as listed. The latest published edition of each standard applies.
- B. WDMA Interior Architectural Wood Stile & Rail Doors Standard
1. ANSI/WDMA I.S.6-A
- C. Architectural Woodwork Institute
1. Architectural Woodwork Standards (AWS)
- D. Building Code References
1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
 2. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies
 3. NFPA 101 – Life Safety Code
 4. IBC – International Building Code, latest edition.
 5. CBC - California Building Code, latest edition.
 - a. UL 10B-Standard for Fire Tests of Door Assemblies (neutral pressure)
 - b. UL 10C-Standard for Positive Pressure Fire Tests of Doors
 6. Intertek Warnock Hersey-Listed Product and Code Compliance Directory
 7. QAI Laboratories-Listing Directory for Building Products
 8. ADA Standards for Accessible Design (Current Edition)
 9. California Air Resource Board (CARB) –formaldehyde emissions standard
 10. Consumer Products Safety Commission (CPSC) 16 CFR 1201 – Standard for Architectural Glazing

1.4 PREINSTALLATION MEETINGS

- A. Conduct pre-installation meeting at Project site.
- B. Discussion Topics:
 - 1. Delivery, storage, and handling.
 - 2. Coordination with hardware and access control installers.
 - 3. Protection of installed doors.

1.5 ACTION SUBMITTALS

- A. Product Data: Each type of door and finish.
 - 1. Core and edge construction.
 - 2. Fire rated doors.
 - 3. Glazed openings.
 - 4. Louvers.
 - 5. Finishes.
- B. Shop Drawings and Schedule:
 - 1. Use same unit designations used in Contract Documents.
 - 2. Hardware and wiring chase preparation.
 - 3. Glazed openings.
 - 4. Louvers.
- C. Samples for Selection:
 - 1. Available standard stain and paint colors and gloss options. Submit samples in the form of actual materials; printed brochures are not acceptable.
 - 2. Available molding profiles for glazed openings.
- D. Samples for Verification:
 - 1. Each required veneer species and factory finish; corner unit showing construction and finish minimum 8 by 10 inches (200 by 250 mm).
 - 2. Light Opening Moldings: Minimum 6 inches (150 mm) long, for each material, type, and finish required.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer warranties transferrable to Owner.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Shall be a company specializing in the manufacture of stile and rail doors with a minimum of 10 years' experience.
- B. Fire Ratings: Fire rated doors shall comply with local building codes as enforced by the AHJ. Doors shall be installed in accordance with NFPA 80. All doors shall bear the appropriate certification labels. Manufacture fire rated doors under the UL or ITS/WH factory inspection program providing the degree of fire protection capability indicated by the door schedule drawings. Provide metal labels permanently fastened on each fire door

at an authorized and licensed facility as evidence of compliance with procedures of the labeling agency. Labels are not to be removed, defaced or made illegible while the door is in service per NFPA 80. Fire labels are not to be painted or pre-finished.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Package factory-finished doors individually in manufacturer's standard plastic bags, stretch wrap, or cardboard cartons.
- B. Store doors inside building in clean, dry location.
- C. Mark each door on top bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity at occupancy levels during remainder of construction period.

1.10 MANUFACTURER WARRANTIES

- A. Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6 mm) in 42-by-84-inch (1065-by-2130-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in 3-inch (0.25 mm in 76-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
- B. Warranty Periods:
 - 1. Solid-Core Interior Doors Life of installation.
 - 2. Interior Stile and Rail Doors Life of installation.
 - 3. Exterior Stile and Rail Doors 3 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Products of Aspiro™ Series | Marshfield-Algoma by Masonite Architectural are specified to indicate requirements for quality and appearance.
 - 1. Website: masonite.com/architectural/products/aspiro-series
 - 2. Phone: 877.332.4484
- B. Equivalent products from a different manufacturers will be acceptable.
- C. Source Control: Supply all wood doors from a single manufacturer.

2.2 MANUFACTURING STANDARDS

- A. Interior Flush Wood Doors: Window & Door Manufacturers Association publication ANSI/WDMA I.S. 1A "Industry Standard for Interior Architectural Wood Flush Doors".

- B. Fire-Rated Wood Doors (where noted): Conforming to NFPA 80; listed and labeled for required ratings based on testing at positive pressure NFPA 252 or UL 10C by UL or other testing agency acceptable to authorities having jurisdiction
 - 1. Temperature-Rise Limit: Where indicated provide doors that have a maximum transmitted temperature end point of not more than 250 deg F (121 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 2. Blocking: Provide composite blocking approved for use in doors of fire-protection ratings indicated as needed to maintain WDMA performance level and eliminate through-bolting hardware.
 - 3. Vertical Edge Construction:
 - a. Category A Positive Pressure: Integral intumescent seals concealed by outer stile where required.
 - b. Category B Positive Pressure: Intumescent seals applied to door frame per requirements of Section 08 7100 Door Hardware where required.
 - 4. Pairs: Fire-retardant stiles with concealed intumescent seals that are listed and labeled for applications indicated without formed-steel edges and astragals.
 - 5. Pairs: Formed-steel edges and astragals with intumescent seals as required for ratings.
 - a. Steel edges and astragals factory primed for field painting.
 - b. Veneer wrapped steel edges in same species and finish as door faces.
 - c. Steel edges and astragals with baked enamel in color selected by Architect from manufacturer's standard offering.
 - d. Stainless steel edges and astragals, #4 satin polish.
- C. Acoustical Rating for Solid Core Doors: Where indicated in door schedule on Drawings, provide STC rated doors supplied with seals and gaskets tested by manufacturer.

2.3 SUSTAINABILITY REQUIREMENTS

- A. Certified Wood: "FSC Pure" per FSC STD-01-001 and FSC STD-40-004.
- B. Adhesives: Meeting testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Composite Wood Products: Manufactured with ultra-low-emitting formaldehyde resins as defined in California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or with no added formaldehyde.

2.4 INTERIOR SOLID CORE FLUSH WOOD DOORS FOR OPAQUE FINISH – PREMIUM PAINTED

- A. Basis of Design: Aspiro™ Series | Marshfield-Algoma™ by Masonite Architectural.
- B. Solid Core Premium Painted Flush Doors (See drawings designations):
 - 1. WDMA Quality grade: Premium.
 - 2. WDMA Performance Level: Extra Heavy Duty.
 - 3. Faces: Medium density overlay (MDO).
 - 4. Vertical Edges: Hardwood over Structural composite lumber. Matching 1/8 inch (3.2mm) high impact edge bonded to structural composite lumber.
 - 5. Horizontal Edges: Structural composite lumber. Clean edge-Bond smooth PVC edge band to structural composite lumber (top), (bottom), (top & bottom).
 - 6. Core: Extra heavy duty wood-based particleboard (PC).

7. Construction: Five Plies; stiles and rails bonded to core, and entire unit is abrasive planed before veneering.
8. Thickness: 1-3/4 inch.
9. Wood Applied Moldings: Design.
 - a. Pattern: See door elevations on Drawings.

C. Solid Core Premium Painted Flush Doors with Louvers (See drawings designations):

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.
2. Metal Louvers: 800A1 Factory primed for field painting.

2.5 DOOR CORE MATERIALS

- A. Particleboard: Wood-based particleboard; ANSI A208.4, Grade LD-2 as required to meet WDMA Performance Duty level specified without added blocking.
- B. Structural Composite Lumber: WDMA T.M.10.

2.6 PAINT FINISH WOOD DOOR FRAMES

- A. Material: Paint grade hardwood.
- B. Frame Profile: As detailed on drawings to match existing conditions.
- C. Trim: Paint grade. As detailed on drawings to match existing conditions.
- D. Trim Stile: As detailed on drawings to match existing conditions.

2.7 FABRICATION

- A. Door Pairs and Fixed Side Panels:
 1. Veneer Matching: Pair match.
- B. Transoms and Side Panels: Same construction as adjacent doors.
 1. Transom Veneer: Continuous match.
- C. Factory Fitting: Fit to frame openings with clearances specified in WDMA I.S. 1A.
 1. Undercut: Maximum 3/8 inch (10 mm) above thresholds.
 2. Fire-Rated Doors: Comply with NFPA 80.
- D. Factory Machining: Machine doors for hardware that is not surface applied.
 1. Verify dimensions for hardware mortises in metal frames before machining.
- E. Openings:
 1. Cut and trim openings and install glazing at factory.
 2. Cut openings and install louvers at factory.
- F. Door Frames:
 1. Supply frames with temporary spreader bars at base.

2. Where indicated provide matching sidelite and transom frames with rectangular wood beads for glazing.

2.8 FINISHES

- A. Finish Grade: Match grade of door.
- B. Transparent: WDMA TR-8, UV-Cured Acrylated Polyester/Urethane
 1. Staining: Standard color selected by Architect. Match Architect's sample. Refer to color specification on drawings.
 2. Sheen: Satin.
- C. Factory-Primed: Primer suitable for finish paint specified in Section 099113 – Exterior Painting, or Section 099123 – Interior Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that door frames are plumb, square, and accurate size.
- B. Inspect each door before installation for damage and defects per WDMA Section F-6.

3.2 INSTALLATION

- A. Hardware installation is conforming to Section 08 7100 – Door Hardware.
- B. Reference Standards:
 1. Fire-Rated Doors: NFPA 80.
 2. Smoke-and Draft-Control Doors: NFPA 105.
- C. Align doors with uniform vertical and top edge clearance.

3.3 REPAIR

- A. Repair of damage or defects is subject to Architect's acceptance, including removal of soiling. Provide new replacement doors for doors that cannot be satisfactorily repaired.

3.4 PROTECTING AND CLEANING

- A. Protect installed doors from damage and soiling.
- B. Clean doors shortly before inspection for Substantial Completion.

END OF SECTION 08 14 00

**SECTION 08 17 00
PREFINISHED METAL DOOR OPENING ASSEMBLIES**

PART I - GENERAL**1.1 SECTION INCLUDES**

- A. Rated & Non-rated, shop pre-finished, site assembled steel frames.

1.2 RELATED SECTIONS

- A. Section 01 20 00 - Coordination: Site meetings.
- B. Section 01 60 00 - Product Requirements: Substitutions, delivery and storage requirements.
- C. Section 08 14 00 - Wood Doors.
- D. Section 08 71 00 - Door Hardware: Hardware, silencers, and weatherstripping.
- E. Section 08 80 00 – Glass and Glazing.

1.3 REFERENCES

- A. ASTM A1008M – Standard for cold rolled material
- B. UBC 7-2-97, UBC 7-4-97 Positive Pressure
- C. ASTM D2197 - Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
- D. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- E. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- F. ASTM D3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- H. ASTM B117 – Standard test for salt spray testing

1.4 SUBMITTALS FOR REVIEW

- A. Section 01 34 00: Submission procedures.
- B. Product Data: Indicate frame configuration and finishes.
- C. Shop Drawings: Indicate frame elevations, reinforcement required, and spacing, location of embosses for hardware, and finish. Submit 6 sets of Shop Drawings.
- D. Samples: Submit two standard frame samples, illustrating factory finished frame colors and surface texture.

1.5 SUBMITTALS FOR INFORMATION

- A. Section 01 34 00: Submission procedures.
- B. Manufacturer's Installation Instructions: Indicate special installation instructions.
- C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Installers:
 - 1. Individuals that are "Certified Prefinished Frame Installers" for the installation of site assembled door frames.
 - 2. Refer to manufacturer's Internet web site for listing of Certified installers.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 60 00: Transport, handle, store, and protect products in a dry area off the ground.
- B. Accept frames on site in manufacturer's box packaging with identification labels intact. Inspect for damage.
- C. Do not open individual boxes until installation is to begin.

1.08 PROJECT CONDITIONS

- A. Section 01 34 00: Coordination and meetings.
- B. Verify actual measurements/openings by field measurement prior to fabrication.
- C. Coordinate the work with frame opening construction, door and hardware installation.
- D. Sequence installation to ensure concealed electric wire connections are achieved in an orderly and expeditious manner.

PART II -PRODUCTS

2.1 FRAME MANUFACTURERS

- A. Timely Industries, A Division of SDS Industries, Inc., 10241 Norris Avenue, Pacoima, CA, 91331-2292; Phone toll free: 800-247-6242 or local at 818-492-3500; Fax: 818-492-3530. Web site: www.timelyframes.com. Or approved equal.
- B. Frames: Provide all frames for project from same manufacturer.
- C. Substitutions: Refer to Section 01 60 00.

2.2 FRAMES

- A. Frame Material: Cold rolled steel, for interior frames.
- B. Frame Throat Opening: to suit finished wall thickness.

- C. Where shown, fire rated frames to have kerf formed into frame profile for installation of smoke gasket or weatherstrip material
- D. Frame Profile: Rated & Non-rated:
 - 1. "S" (Standard) Series, 0.9 mm (20 gage) thick – typical interior openings
 - 2. "CK" Series, 1.2 mm (18 guage) thick, with kerf for door seal/gasket – fire rated, at mechanical access & storage room doors as listed on drawings
 - 3. "P" Series, 1.2 mm (18 guage) thick – finish trim for pocket doors
- E. Side Light Frames: 0.9 mm (20 gage) thick.
- F. Frame Casings:
 - 1. Material: Steel casings with corner alignment clips.
 - 2. Type
 - a. Standard Steel Type: Model TA-8 with 6 mm (1/4 inch) reveal, on steel frames. Fit factory assembled units with MiterGard corner alignment clips.

2.3 ACCESSORIES

- A. Reinforcement Bracket for Closer: Regular arm closer, Model TA-10.
- B. Reinforcement Brackets for Rim Exit Device: Model TA-12
- C. Reinforcement Brackets for Door Guards: Model TA-10
- D. Weatherstripping/Smoke Gasket: TA-46 (QDS500) 90 minute rated gasket for kerfed frames. Provide for all CK Series frames with factory installed gasket. Provide manufacturer's standard colors to closely match frame color. (Custom colors not available on TA-46)
- E. Silencers: TA-5 vinyl, clear stick-on type. Silencers not required on Kerfed frames or frames scheduled to receive stop mounted gasket or weatherstrip
- F. Glass Stops: Model TA-14 removable rolled steel, shape, butted ends, Prepunch & countersink for flat head tek screws.
- G. Adjustable strikes: Emboss frames for TA-1 strike for cylindrical lock. Provide TA-1 strike in finish compatible with hardware finish. (Strike supplied with cylindrical lock cannot be used with standard frame because of unique strike location and screw piercing method)
- H. Prepare frames for ASA 4-7/8" strikes where required. Provide minimum 1/4" depth of threads in factory tapped screw holes
- I. Fasteners:
 - 1. Interior Frames: #6 Drywall type length sufficient to penetrate studs or structure at least 1/2".

2.4 FABRICATION

- A. Openings for single swing, pair, borrowed light and sidelight frames to be pre-cut, notched and fabricated at the manufacturer's facility. For fire rated and exterior openings, provide kerf at stop for installation of smoke gasket or weatherstrip

- B. Provide minimum 14 guage hinge reinforcement plate tapped for machine screws supplied with hinges. Hinge plate to be mechanically attached to hinge emboss on frame
- C. Casing Clips: Fabricate frames with factory applied, heat treated clips to ensure no deflection in the clip upon application or removal of casing. Attachment clips may not be of same material as frame
- D. Provide notches, tabs and/or stops for positive alignment of frame parts at all corners
- E. Mullions to be notched as required to provide tight joints
- F. Provide manufacturer's standard mullion brackets for positive connection of frame and mullion parts
- G. Provide manufacturer's standard steel glass stop pre-cut to exact length. Fire rated glazed openings to have hole for installation screw within 2" of each end of stop piece
- H. Provide insert channel full width of borrowed lights installed on finish floor. Provide full width head channel for ceiling height units if required
- I. Provide adequate structural support (by others) for ceiling insert channel for ceiling height frames
- J. Transoms bars fixed type with same profiles as jamb and head
- K. Attach approved mylar label to each fire-rated frame indicating fire rating details
- L. Primed frames to have 90 minute fire label embossed into frame in lieu of mylar label.
- M. Factory install TA-46 smoke gasket on all prefinished, CK series frames. Install with factory mitered corners to ensure adequate seal and pleasing appearance.
- N. Silencers:
 - 1. Provide three (3) single silencers for single doors and mullions of double doors on strike side.
 - 2. Provide two (2) single silencers on frame head at double doors without mullions.

2.5 FINISH

- A. Frame Units: Prefinshed with factory applied impact resistant, polyurethane baked enamel finish.
- B. Casing:
 - 1. Steel: Prefinished with factory applied impact resistant, polyurethane baked enamel finish.
 - 2. Primer: Hot dipped galvanized with 2 coats of white primer
- C. Colors:
 - 1. As noted on the Door Schedule on the drawings. Verify with City staff.

PART III - EXECUTION

3.1 EXAMINATION

- A. Verify acceptability of existing conditions before starting work.

- B. Verify that opening sizes and wall thicknesses are within specified tolerances.
- C. Verify that all finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

- A. Install frames in accordance with manufacturer's requirements.
- B. Anchor frames with screws located at every casing clip or every 11" as shown on manufacturer's instructions. Field verify quantity and location of fasteners prior to installing casing.
- C. Install Prefinished frames near end of the project after completing wall painting and wall coverings.
- D. Install frames using Certified Installers.
- E. Coordinate installation of glass and glazing in glazed units.
- F. Coordinate installation of frames with installation of hardware specified in Section 08 71 00 and doors in Section 08 14 05.
- G. Touch-up blemishes on finished frames.

3.3 SCHEDULE

- A. Refer to Door Schedules on the plans for additional information

END OF SECTION 08 17 00

**SECTION 08 33 00
COILING DOORS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Rolling service doors.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications: Support framing and framed opening.
- B. Section 06 20 00 - Finish Carpentry: Wood jamb and head trim.
- C. Section 08 71 00 - Door Hardware: Product Requirements for cylinder core and keys.
- D. Section 09900 - Painting: Field applied finish.

1.3 REFERENCES

- A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.
- B. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
- C. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
- D. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- E. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- G. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- H. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- J. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Details of construction and fabrication.
 - 4. Installation instructions.
- C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

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

1.9 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

- A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.
- B. Warranty: Manufacturer's limited door system warranty for 2 years for all parts and components.
- C. PowderGuard Finish
 - 1. PowderGuard Premium Applied to curtain, guides, bottom bar, headplates: Manufacturer's limited Premium Finish warranty for 2 years.
 - 2. PowderGuard Zinc Base Coat applied to guides, bottom bar, headplates plus PowderGuard Premium applied to curtain and top coat for guides, bottom bar, headplates: Manufacturer's limited Zinc Finish warranty for 4 years.
 - 3. PowderGuard Textured: Applied to curtain, guides, bottom bar, headplates: Manufacturer's limited Textured Finish warranty for 3 years.
 - 4. PowderGuard Zinc Base Coat applied to guides, bottom bar, headplates plus PowderGuard Textured applied to curtain and top coat for guides, bottom bar, headplates: Manufacturer's limited Zinc Finish warranty for 4 years.
 - 5. PowderGuard Max: Applied to curtain, guides, bottom bar, headplates: Manufacturer's limited Max Finish warranty for 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 ROLLING SERVICE DOORS

- A. Industrial Doors: Overhead Door Corporation, Model 610 Rolling Service Doors.
 - 1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - a. Flat profile type F-265 for doors up to 18 feet 4 inches (5.59 m) wide, fabricated of:
 - 1) 16 gauge galvanized steel.
 - 2. Slats and Hood Finish:

- a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
 - 1) Powder Coat:
 - (a) PowderGuard Premium powder coat, custom color as noted in the Finish & Materials Legend located on the Exterior Elevation Drawings. The contractor shall be responsible for matching the selected color.
 - 2) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
3. Weatherseals:
 - a. Vinyl bottom seal.
 - b. Guide weatherseal.
4. Bottom Bar:
 - a. Extruded aluminum for doors up to 15 feet 4 inches (4.67 m) wide.
 - b. Two primed steel angles for doors over 15 feet 4 inches (4.67 m) wide.
 - c. Two galvanized steel angles.
5. Guides: Three structural steel angles.
6. Brackets:
 - a. Hot rolled prime painted steel to support counterbalance, curtain and hood.
 - b. Galvanized steel to support counterbalance, curtain and hood.
7. Finish; Bottom Bar, Guides and Brackets:
 - a. PowderGuard Premium powder coat, custom color as noted in the Finish & Materials Legend located on the Exterior Elevation Drawings. The contractor shall be responsible for matching the selected color.
8. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
9. Hood:
 - a. 24 gauge galvanized steel with intermediate supports as required.
10. Manual Operation:
 - a. Manual push up for doors up to 96 SF.
 - b. Chain hoist for doors up to 96 SF.
11. Wind Load Design:
 - a. Standard wind load shall be 20 PSF.
12. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
13. Locking:
 - a. Two interior bottom bar slide bolts for manually operated doors.
14. Wall Mounting Condition:
 - a. Face-of-wall mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.
- F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.
- G. Install perimeter trim and closures.
- H. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION 08 33 00

**SECTION 08 33 13
COILING COUNTER DOORS**

PART I-GENERAL

1.01 Scope:

The extent of rolling counter fire doors is shown on the drawings.

Provide complete operating door assemblies, including door curtains, guides, counterbalance mechanisms, hardware, operators and installation accessories, as shown on the drawings and herein specified.

1.02 Related Work Specified Elsewhere:

Preparation of openings, structural supports, access panels, trim field painting.

1.03 Quality Assurance:

A. Counter Shutter.

Provide door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components. Rolling door, as manufactured by "Overhead Door Corporation". "Overhead Door Corporation" is listed as a standard of quality.

1.04 Submittals:

A. Submit product shop drawings and data to the architect for review. Refer to specification Section 01 34 00 for additional requirements. Also see paragraph 2.05 for additional information.

PART II-PRODUCTS

2.01 Rolling Counter Fire Doors:

Rolling counter fire doors shall be Model No. LCN-3 as manufactured by Overhead Door Corporation, and erected in accordance with Overhead Door Corporations instructions and standards by its authorized representatives. Doors shall be manufactured in compliance with Underwriter's Laboratories listed procedures and bear a 3/4 hour Class C label. Opening, frame and sill preparation will be performed by others as required under other sections of specification.

Operation of door shall be by removable hand crank.

Automatic closing shall be controlled by magnetic release holders to connect to building fire alarm or smoke detector system.

Curtain shall consist of 24 gauge galvanized, pre-paint, steel roll-formed, interlocking flat-faced slats, 1/2" deep. Endlocks shall be continuous. Bottom bar shall be a single angle. Locks shall be cylinder locks at one of bottom bar.

Brackets shall be 10 gauge steel to support counter-balance and hood and provide end

closure.

Rectangular hood shall be 24 gauge galvanized, pre-paint, steel with a fuse-released internal flame baffle. End covers shall conceal tension and drive mechanisms.

Guides shall be 10 gauge galvanized steel mounted face of wall as shown on drawings. Guides shall be bolted to jambs with anchors 18" O.C. guide seals shall be at the base of guide.

Counterbalance assembly shall consist of steel pipe housing the steel helical torsion springs, supporting the curtain with a maximum deflection of 0.03 in./ft. of width. Counterbalance shall be supported on low-friction sealed ball bearings.

All ferrous surfaces except working machinery parts and galvanized surfaces, shall receive a factory coat of rust-inhibiting primer.

2.02 Access Doors:

Provide access doors as manufactured by "Inryco/Milcor", Model "DW" or approved equal. Access doors shall have 16 gage steel frames and 14 gauge panels and the drywall head of galvanized steel. Access doors shall be provided with a cylinder lock and continuous piano hinge or a minimum of two spring hinges the removal of whose pins allows the access door panel to be removed.

2.03 Brackets:

Provide mounting brackets of manufacturer's standard design.

2.04 Inserts and Anchorages:

Furnish inserts and anchoring devices which must be set in stud wall for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

2.05 Submittals:

Manufacturer's Data. Submit six (6) copies of manufacturer's specifications, roughing-in diagrams, and installation instructions for each type and size of shutters. Include manufacturer's data, operating instructions and maintenance data. Indicate by transmittal form that installer has received a copy of diagrams and installation instructions.

Shop Drawings. Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets.

PART III – INSTALLATION

3.01 Field Verifications:

Verify all existing conditions and dimensions in the field prior to preparing and submitting shop drawings for review.

3.02 Installation:

Install all equipment and materials per the manufacturer's installation instructions and details. Include all required equipment, parts, accessories, and anything else required for the complete installation and operation of the counter shutter.

3.03 Protection after Installation:

The contractor shall take the necessary steps to protect the finish, installation, and operation of the counter shutter after installation.

3.04 Cleaning:

- A. Remove all packaging, dirt, and debris from the premises after installation.
- B. Provide a final cleaning of the entire counter shutter to remove any dust or dirt prior to completion of the project.

END OF SECTION 08 33 13

**SECTION 08 71 00
DOOR HARDWARE****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Door Hardware for new interior and exterior doors.

B. Related Sections:

1. Section 06 20 00 - Finish Carpentry: Finish Hardware Installation
2. Section 07 92 00 - Joint Sealers – exterior thresholds

1.2 SPECIFIC OMISSIONS: Hardware for the following is specified or indicated elsewhere.

- A. Signs, except where scheduled.
- B. Toilet accessories, including grab bars.
- C. Installation.
- D. Rough hardware.
- E. Access doors and panels, except cylinders where detailed.

1.3 REFERENCES:

Use date of standard in effect as of Bid date.

- A. American National Standards Institute – ANSI 156.18 – Materials and Finishes.
- B. BHMA – Builders Hardware Manufacturers Association
- C. DHI – Door and Hardware Institute
- D. NFPA – National Fire Protection Association
 1. NFPA 80 – Fire Doors and Windows
 2. NFPA 105 – Smoke and Draft Control Door Assemblies
 3. NFPA 252 – Fire Tests of Door Assemblies
- E. UL – Underwriters Laboratories
 1. UL10C – Positive Pressure Fire Tests of Door Assemblies.
 2. UL 305 – Panic Hardware
- F. WHI – Warnock Hersey Incorporated
- G. State of California Building Code (CBC), latest edition.
- H. Local applicable codes
- I. SDI – Steel Door Institute
- J. WI – Woodwork Institute
- K. AWI – Architectural Woodwork Institute
- L. NAAMM – National Association of Architectural Metal Manufacturers

1.4 SUBMITTALS & SUBSTITUTIONS

A. SUBMITTALS:

Submit six copies of schedule per Section 01 34 00. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Type, style, function, size, quantity and finish of hardware items.
2. Use BHMA Finish codes per ANSI A156.18.
3. Name, part number and manufacturer of each item.
4. Fastenings and other pertinent information.
5. Description of door location using space names and numbers as published in the drawings.
6. Explanation of abbreviations, symbols, and codes contained in schedule.
7. Mounting locations for hardware.
8. Door and frame sizes, handing, materials, fire-rating and degrees of swing.
9. List of manufacturers used and their nearest representative with address and phone number.
10. Catalog cuts.
11. Wiring Diagrams.
12. Manufacturer's technical data and installation instructions for electronic hardware.
13. Hardware schedules for each door.

B. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.

C. Deviations: Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.

D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.

E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.

F. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.5 QUALITY ASSURANCE:

A. Qualifications:

1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
 - a. Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
2. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
3. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

4. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C / California State Fire Marshal Standard 12-7-4 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required in tumescent seals. Furnish openings complete.
5. Note: scheduled resilient seals may exceed selected door manufacturer's requirements.
6. See 2.6.E for added information regarding resilient and in tumescent seals.
7. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.7 PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 1. Location of embedded and attached items to concrete.
 2. Location of wall-mounted hardware, including wall stops.
 3. Location of finish floor materials and floor-mounted hardware.
 4. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
 5. Manufacturer templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation. Do not order hardware until the submittal has been reviewed by the frame and door suppliers for compatibility with their products.

1.8 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties:

a.	Locksets:	Three years
b.	Extra Heavy Duty Cylindrical Lock:	Seven Years
c.	Exit Devices:	Three years mechanical One year electrical
d.	Closers:	Ten years mechanical Two years electrical
e.	Hinges:	Two year
f.	Other Hardware	Two years

1.9 COMMISSIONING:

- A. Conduct these tests prior to request for certificate of substantial completion:
1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
 2. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

Listed acceptable manufacturers: submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:
Hinges	(IVE) Ives
Continuous Hinges	(IVE) Ives
Key System	(SCH) Schlage
Locks	(SCH) Schlage
Exit Devices	(VON) Von Duprin
Closers	(LCN) LCN
Push & Pull Plates	(IVE) Ives
Kickplates	(IVE) Ives
Stops & Holders	(IVE) Ives
Overhead Stops	(GLY) Glynn-Johnson
Thresholds	(NGP) NGP
Seals & Bottoms	(NGP) NGP
Aluminum Door Locks	(ADA) Adams Rite

2.2 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. **Conventional Hinges: Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.**
 - a. **Outswinging doors: non-ferrous with non-removable (NRP) pins and security studs.**
 - b. **Non-ferrous material at exteriors and at doors subject to corrosive atmospheric conditions.**
- D. **Continuous Hinges (at all exterior doors):**
 - 1. Geared-type aluminum.
 - a. Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
 - 2. Pinned steel/stainless steel type: continuous stainless steel, 0.25-inch diameter stainless-steel hinge pin.
 - a. Use engineered application-specific wide-throw units as needed to provide maximum swing degree of swing, advise architect if required width exceeds 8 inches.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Mortise Locksets and Latchsets: as scheduled.
 - 1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
 - 2. Latchbolts: 3/4 inch throw stainless steel anti-friction type.
 - 3. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
 - a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
 - 4. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
 - 5. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
 - 6. Deadbolts: stainless steel 1-inch throw.
 - 7. Electric operation: Manufacturer-installed continuous duty solenoid.
 - 8. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
 - 9. Scheduled Lock Series and Design: Schlage L series, 06A design.
 - 10. Certifications:
 - a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
 - b. ANSI/ASTM F476-84 Grade 31 UL Listed.
- B. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.
 - 1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.

2. Locking Spindle: stainless steel, integrated spring and spindle design.
3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel, or stainless steel.
4. Latchbolt: solid steel.
5. Backset: 2-3/4" typically, more or less as needed to accommodate frame, door or other hardware.
6. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2" clearance from lever mid-point to door face.
7. Electric operation: Manufacturer-installed continuous duty solenoid.
8. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
9. Lock Series and Design: Schlage ND series, "Rhodes" design.
10. Certifications:
 - a. ANSI A156.2, 1994, Series 4000, Grade 1.
 - b. UL listed for A label and lesser class single doors up to 4ft x 8ft.

C. Electronic Door Hardware: As scheduled on architectural plans and technology plan.

1. Electronic lever locksets & latchsets
2. Locksets & Latchsets with electronic keypad.
3. Locksets & Latchsets with electronic card readers.
4. The contractor shall coordinate all door hardware requirements with the Technology Plan for each building and provide hardware units compatible with equipment/systems specified on the Technology Plans.
5. The contractor shall provide all required conduits, junction boxes, wiring, electrical power, and anything else required for a complete and operation system.

D. Exit Devices / Panic Hardware

1. General features:
2. Independent lab-tested 1,000,000 cycles.
3. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
4. 0.75-inch throw deadlocking latchbolts.
5. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
6. No exposed screws to show through glass doors.
7. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
8. Releasable in normal operation with 15-lb. maximum operating force per California State Fire Marshal Standard 12-10-3, and with 32 lb. maximum pressure under 250-lb. load to the door.
9. Where devices span over door lite frame and the face of the selected lite manufacturer's frame is raised from the face of the door, furnish panic hardware manufacturer's fitted shims or glass-bead kits at no additional cost to the project.
10. Comply with CBC Section 1003.3.1.9.

2.5 SPECIFIED FEATURES:

- A. Non-Fire Rated Devices: cylinder dogging.
- B. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.

2.6 CLOSERS

- A. Surface Closers: LCN 4041 series
- B. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
- C. ISO 2000 certified. Units stamped with date-of-manufacture code.
- D. Independent lab-tested 10,000,000 cycles.
- E. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
- F. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
- G. Adjustable to open with not more than 5.0lbs pressure to open at exterior doors and 5.0lbs at interior doors. As allowed per California Building Code, Section 1133B.2.5, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15lbs.
- H. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
- I. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
- J. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
- K. Exterior doors: seasonal adjustments not required for temperatures from degrees F to -30 degrees F, furnish checking fluid data on request.
- L. Non-flaming fluid, will not fuel door or floor covering fires.
- M. Pressure Relief Valves (PRV) not permitted.

2.7 Overhead Concealed Closers:

- A. Power transmitted to door separately from hanging means. Closer spindle does not support the door. Cast iron cylinders with hydraulically checked rack and pinion construction and single piece forged pistons. Separate non-critical sweep and latch speed valves.
 - 1. LCN 2030 series: concealable in 1-3/4inch x 4inch tube, single-lever arm & track power transmission, concealed-in-track bumpers where scheduled.

2.8 OTHER HARDWARE

- A. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- B. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- C. Door Stops: Provide stops to protect walls, casework or other hardware.

1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
 2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
- D. Seals: Finished to match adjacent frame color. Resilient seal material: polyurethane, polypropylene, nylon brush, silicone rubber or solid high-grade neoprene as scheduled. Do not furnish vinyl seal material. UL label applied to seals on rated doors. Substitute products: certify that the products equal or exceed specified material's thickness and durability.
1. Proposed substitutions: submit for approval.
 2. Solid neoprene: MIL Spec. R6855-CL III, Grade 40.
 3. Non-corroding fasteners at in-swinging exterior doors.
 4. Fire-rated Doors, Resilient Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements. Where rigid housed resilient seals are scheduled in this section and the selected door manufacturer only requires an adhesive-mounted resilient seal, furnish rigid housed seal at minimum, or both the rigid housed seal plus the adhesive applied seal. Adhesive applied seals alone are deemed insufficient for this project where rigid housed seals are scheduled.
 5. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C / UBC Standard 7-2. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required
- E. Thresholds: As scheduled and per details. Comply with CBC Section 1133B.2.4.1. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
1. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Non-ferrous 1/4inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).
 2. Fire-rated openings, 90min or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, request direction from Architect.
 3. Fire-rated openings, 3hour duration: Thresholds, where scheduled, to extend full jamb depth.
 4. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
 5. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- F. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where adhesive mounted seal occurs. Leave no unfilled/uncovered pre-punched silencer holes.

2.9 FINISH:

- A. Generally BHMA 626 Satin Chromium.
 - 1. Areas using BHMA 626 to have push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.
- C. Aluminum items: match predominant adjacent material. Seals to coordinate with frame color.

2.10 KEYING REQUIREMENTS:

- A. Key System: Schlage Everest "D" restricted utility-patented keyway, interchangeable core. Utility patent protection to extend at least until 2014. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner and I-R Security & Safety Consultants representatives to determine system keyway(s), keybow styles, structure and degree of geographic exclusivity. Furnish Owner's written approval of the system.
- B. Keys
 - 1. New factory registered master key system.
 - 2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
 - 3. Furnish 12 construction keys.
 - 4. Furnish 3 construction control keys.
- C. Key Cylinders: furnish utility patented, 6-pin solid brass construction.
- D. Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: use secured shipment direct from point of origination to Owner.
 - 1. For estimate: 3 keys per change combination, 3 master keys per group, 3 grand-master keys, 3 control keys.
 - 2. For estimate: VKC stamping plus "Do Not Duplicate".
- F. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION**3.1 ACCEPTABLE INSTALLERS:**

- A. Can read and understand manufacturers' templates, suppliers' hardware Schedules and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation.

- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
 - 1. Notify Architect of code conflicts before ordering material.
 - 2. Locate levers, key cylinders, t-turn pieces, touchbars and other operable portions of latching hardware between 30 inches to 44 inches above the finished floor, per CBC Section 1133B.2.5.1.
- C. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- D. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.
- E. Existing frames and doors to be retrofitted with new hardware:
 - 1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise. Remove existing floor closers not scheduled for reuse, fill cavities with concrete and finish smooth
 - 2. Cut and weld existing steel frames currently prepared with 2-3/4" height strikes. Cut an approx. 8" section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.
 - 3. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.
 - 4. Glue in solid wood block fillers to fill cut outs in existing wood doors, sand surfaces smooth. Alternatively, use an approved epoxy-based wood filler product, submit product data for approval.

3.3 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
 - 1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 - 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
 - 3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
 - 4. Replace fasteners damaged by power-driven tools.
- B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees and maximum allowable degree of swing.

- E. Drill pilot holes for fasteners in wood doors and/or frames. Centerpunch hole locations before using self-drilling type screws to prevent skating. Replace screws that are not centered in their holes.
- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.
- G. Field verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware. Remove existing hardware not being reused.
- H. Disable or remove existing floor closers where they exist. If disabled cut or remove spindle.
- I. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed extended arms on closers.
- J. Provide proper brackets to accommodate the mounting of closers on doors with flush transoms.

3.4 ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
 - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
 - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
 - 3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
 - 4. Adjust door closers per 1.9 this section.
- B. Inspection: Use hardware supplier's consultant or consultant's agent. Include supplier's report with closeout documents.
- C. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
 - 1. Re-adjust hardware.
 - 2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.
 - 3. Identify items that have deteriorated or failed.
 - 4. Submit written report identifying problems

3.5 DEMONSTRATION:

- A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for minimum hardware requirements.
- B. Refer to the Technology Plans for additional requirements.
- C. The contractor shall be responsible to provide all required hardware not specifically listed on the drawings or in these specifications in order to make the door(s) fully functional for their intended use. The contractor shall submit a complete hardware schedule in their door hardware submittal for review to the Architect.
- D. Miscellaneous Material:
 - ADA Adams Rite
 - IVE H. B. Ives
 - GLY Glynn-Johnson Hardware
 - LCN LCN Closers
 - NGP National Guard Products
 - SCH Schlage Lock Company
 - STA Stanley
 - VON Von Duprin

END OF SECTION 08 71 00

**SECTION 08 80 00
GLAZING**

PART I - GENERAL

1.1 Scope:

- A. The extent of glass and glazing work is shown on the drawings, sometimes by abbreviations as indicated herein.
- B. The required applications of glass and glazing include the following:
 - 1. Glazing new exterior doors and windows.
 - 2. Glazing new interior doors and windows.

1.2 Quality Assurance:

- A. Fire-Resistant Glass.
 - 1. Tested and listed by U.L. for "fire resistance" if indicated.

1.3 Submittals:

- A. Manufacturer's Data, Glass.
 - 1. Submit six (6) copies of manufacturer's specifications and installation instructions for each type of glass required. Include test data substantiating that glass complies with specified requirements. Indicate by copy of transmittal that Glazier has received copy of handling and glazing instructions.
- B. Manufacturer's Data, Glazing Materials.
 - 1. Submit six (6) copies of manufacturer's specifications, and installation instructions for each type of glazing sealant and compound, gasket and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown. Show by transmittal that one (1) copy of each recommendation and instruction has been distributed to the Glazier.
- C. Samples, Glass.
 - 1. Submit six (6) 6" square samples of each type of glass required. Architect's review of samples will be for color, texture and pattern only. Compliance with other requirements is the exclusive responsibility of the Contractor.
 - 2. Safety glazing film samples shall be reviewed in place and approved by Project Team prior to ordering. Installer to be well experienced with installing film onsite, free of debris and air bubbles, minimal seams and minimal gaps between film and glazing.
- D. Samples, Glazing Materials.
 - 1. Submit six (6) 6" long samples of each color required for each type of glazing sealant or gasket exposed to view. Install sample between two (2) strips of material similar to or representative of channel surfaces where sealant or gasket will be used, held apart to represent typical joint widths. Samples will be reviewed by Architect for color and texture only. Compliance with other

requirements is the exclusive responsibility of the Contractor.

1.4 Job Conditions:

- A. The glazier must examine the framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing is to be performed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to the glazier.
- B. Weather conditions. Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.

PART II - PRODUCTS

2.1 Glass:

- A. Exterior Glazing: 1" dual glazed, low 'E', insulated glass, clear tint.
- B. Interior Glazing: Single ¼" lites, clear. Provide tempered glass where indicated on the plans and required by the CBC.
- C. Translucent Film (where noted): Provide a translucent, view obscuring film at windows indicated on the drawings. Submit samples to architect for review prior to installation.
- D. Spandrel Glass (where noted): Provide spandrel glass at windows indicated on the drawings. Submit samples to architect for review prior to installation.
- E. Tempered Glass (TG). Plate glass FS DD-G0451, Type 1, which has been heat-strengthened by manufacturer's standard process after cutting to final size, to achieve a flexural strength of four (4) times normal glass strength; as indicated on drawings. ¼" clear at exterior, ¼" clear at interior.

2.2 Glazing Sealants/Compounds:

- A. General. Provide exposed glazing materials of color to match aluminum. Color to be selected by Architect from manufacturer's standard colors. Provide hardness of materials as recommended by the manufacturer for the required application and condition of installation in each case. Provide only compounds which are known (proven) to be fully compatible with surfaces contacted.
- B. Silicone Rubber Glazing Sealant (SR-GS). 100% silicon rubber, one-part elastomeric sealant, complying with FS TT-S001543, Class A. Provide acid-type for non-porous channel surfaces, and provide non-acid type for porous channel surfaces (where any of the channel surfaces are porous).

2.3 Miscellaneous Glazing Materials:

- A. Setting blocks. Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used.
- B. Spacers. Neoprene, 40-50 durometer hardness, with proven compatibility with sealants used.
- C. Compressible Filler Rod (CP-FR). Closed-cell or waterproof jacketed rod stock of synthetic

rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

- D. Cleaners, primers and sealers. Type recommended by sealant or gasket manufacturer.

PART III - EXECUTION

3.1 Standards and Performance:

- A. Installation must withstand normal temperature changes, wind loading, moisture penetration, impact loading (for operating sash and doors), without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- B. Protect glass from edge damage at all times during handling, installation and operation of the building.
- C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. The glazier is responsible for correct glass size for each opening, within the tolerances and necessary dimensions established.
- D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives direct otherwise.
- E. Comply with "Glazing Manual" by GANA (Glass Association of North America) except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
- F. Inspect each piece of glass immediately before installation, and eliminate any which have observable edge damage or face imperfections.
- G. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
- H. Cut and install colored (tinted) and heat absorbing glass as recommended in "Technical Services Report No. 104" by PPG Industries.
- I. Install polysulfide sealants as recommended by Tremco/Vulkem, except as otherwise recommended by the sealant manufacturer.
- J. Safety glazing film samples shall be reviewed in place and approved by Project Team prior to ordering. Installer to be well experienced with installing film on site, free of debris and air bubbles, minimal seams and minimal gaps between film and glazing.

3.2 Preparation for Glazing:

- A. Clean the glazing channel or other framing members to receive glass immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

3.3 Glazing:

- A. Install setting blocks of proper size at quarter points of sill rabbet. Set blocks in thin course of the heel-bead compound, if any.
- B. Provide spacers inside and out, and of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Voids and Filler Rods.
 - 1. Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.
- D. Do not attempt to cut, seam, nip or abrade glass which is tempered, heat strengthened, or coated.
- E. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- F. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel so as to eliminate dirt and moisture pockets.
- G. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.
- H. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.
 - 1. Gasket Glazing.
 - a. Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in the glazing system.
 - 2. Safety Glazing Film Installation.
 - a. Safety glazing film samples shall be reviewed in place and approved by Project Team prior to ordering. Installer to be well experienced with installing film on site, free of debris and air bubbles, minimal seams and minimal gaps between film and glazing.

3.4 Cure, Protection and Cleaning:

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

- B. Protect exterior glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.
- C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.
- D. Maintain glass in a reasonably clean condition during construction so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.
- E. Wash and polish glass on both faces not more than four days prior to District's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

END OF SECTION 08 80 00

**SECTION 09 24 00
CEMENT PLASTERING**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide new lath, waterproofing, and Portland cement plaster, finish texture as called out on the Drawings.

1.2 RELATED WORK

- A. Section 09 91 13 & 09 91 23 - Painting.

1.3 PROTECTION

- A. Provide protection of materials and assemblies in place from plastering operations. Drawings are not necessarily intended to assign construction sequence or method, therefore, protection of in-place materials and assemblies may be required in excess of that which can be construed from drawings. Furnish, install, then remove all protection and scaffolding or staging at no additional cost.

1.4 SUBMITTALS

- A. Submit samples of color and texture for Architect review in accordance with Section 01 34 00.
- B. Provide 4 foot by 4 foot sample of each plaster system required on project. Once sample installation has been approved, that sample becomes the standard of quality expected for that system throughout the project.
- C. Provide samples of articulated rigid foam cornice material.

1.5 QUALITY CONTROL

- A. It is intended that the work of this section follow the guidelines for plaster and stucco work prescribed by the Lath and Plaster Information Bureau in the Lath and Plaster Information Manual, latest edition. In some instances these specifications deviate from those prescribed guidelines with respect to fiber reinforcement and the prohibition of plastic cement.
- B. Guarantee: Provide a two year guarantee against cracks, blisters, pits and discoloration due to defective materials or improper workmanship.

PART 2 - PRODUCTS

2.1 PLASTER MATERIALS

- A. Cement: ASTM C150, Type I or II, Portland. No plastic cement will be accepted.
- B. Lime: ASTM C 206, dry hydrated type. Lime putty, if proposed, shall weigh more than 83 pounds per cubic foot.
- C. Sand: ASTM C144, clean and well graded from coarse to fine.
- D. Water: clean and free from injurious amounts of acid, alkali, and organic matter.
- E. Pre-Mixed Mortar with Waterproofing Additive (to be used in lieu of A through C above): Provide Laticrete International 226 Crete Powder gauged with 8510 Latex Admix.

- F. Plaster reinforcing: Provide Hills Brothers Chemical (714/998-8800) Hi-Fibe P-1510 fibers at 1/5 pound per 100 pounds of cement. As an alternate, provide chopped, alkali resistant glass fibers (1/2 pound per 100 pounds of cement), polyester (1/3 pound per 100 pounds of cement), nylon (1/4 pound per 100 pounds of cement, or polypropylene (1 pound per 100 pounds of cement). Reinforcing shall be used for introduction into scratch and brown coats of exterior 3-coat plaster, scratch coat only for tile and stone base. Do not use reinforcing in veneer plaster systems of less than 3/16 inch overall thickness.
- G. Algaecide: Provide chemical algaecide for introduction into finish coat of plaster where plaster/stucco is to remain un-painted and used on exterior within 4 feet of any landscape planting or irrigation system. Ensure that chemical used for algaecide will not discolor plaster/stucco.
- H. Finish Coat Texture: 20/30 Sand Float.

2.2. LATH AND ACCESSORIES

- A. Lath for Portland Cement Plaster:
 - 1. Wood Studs and Blocking: K-Lath Corporation, Aqua K-Lath or Stucco-Rite, Type SFB, standard for 16" support spacing, heavy duty for 24" support spacing.
 - 2. Metal Studs: Flat or Self-furring diamond mesh, galvanized sheets, 3.4 pounds per square yard.
 - 3. Soffits and Ceilings: K-Lath Corporation. Gun Lath, Type F-F B, standard for 16" support spacing, heavy duty for 24" support spacing, except galvanized hi-rib, self-furring lath at exterior where shown.
 - 4. Corner Reinforcement: K-Lath Corporation, Kwik Corner, for exterior angles; Bentrite welded wire mesh, 2" X 2" angle for interior angles.
 - 5. Paper: Meeting FS UU-B-790a, Type 1. Style 2, Grade D, two layers, "6(-minute)" rated water-vapor resistance, Fortifiber Super Jumbo-Tex. or other approved manufacturer.
- B. Accessories: Provide all trim such as reveals, reglets, cornerite, beads, screeds, and prefabricated joints. Refer to Drawings for individual items incorporated into construction.
 - 1. All accessories shall be fabricated or manufactured from aluminum where incorporated in plaster systems located at exterior unconditioned building areas, and interior areas subject to elevated moisture conditions (defined as 70 percent RH on a sustained basis).
- C. Hot-Dip galvanize all fastening devices such as staples, nails, screws, and wire ties. No electro-galvanizing is acceptable.
 - 1. Wire gage: Use 8 gage hot-dip galvanized wire unless heavier gage is required by local building code regulations.
 - 2. In areas which are wet, potentially wet or are expected to have high moisture or humidity, use stainless steel.
- D. Reinforcing Mesh: welded fabric, galvanized steel, for mortar beds which are required by Drawings or manufacturer publications. Size: 1-1/2 in. X 2 in. or 2 in. square mesh, minimum 16 gauge.
- E. Bonding Agent: Provide Plaster-Weld, or other approved, to allow proper bond of plaster to substrate.
- F. Color: Provide integral coloring agent as selected by Architect, manufactured by La Habra, Omega, Highland, or other approved. Integral coloring is to be used where field painting is not required over plaster systems.

PART 3 - EXECUTION

3.1. SURFACE PREPARATION

- A. Properly prepare surfaces, substrates and previously installed assemblies for acceptance of plaster systems.
- B. Ensure that existing surfaces are clean and free of loose and foreign material. Apply necessary surface treatments such as bonding agents.
- C. Lightly sandblast or acid wash existing surfaces where such treatment is recommended by the Plastering Institute. and where such treatment will not harm other surfaces or assemblies.

3.2. LATHING

- A. General: Apply with long dimension at right angles to the supports. Extend both horizontal and vertical factory laps. On walls, install first course at bottom. and work up. Work from right to left. Stagger all vertical laps.
- B. Wood Framing: Attachments shall securely engage the back wire within the lath and be spaced no more than 6" o.c. on each support.
- C. Vertical Surfaces: Nails must have a minimum penetration of 3/4" into the support unless otherwise required by code. Nails shall be hot-dip galvanized (no electro-galvanized will be accepted). Staples of 14 gauge galvanized wire, 1-1/4" long and 3/4" wide may be used.
- D. Horizontal and Sloping Surfaces: Nails shall be hot dip galvanized (no electro-galvanized) 11 gage. 1-1/2" long. barbed with 7/16" head unless otherwise required by code. All nails must be "driven home". Staples of 14 gage galvanized wire, 1-3/8" long and 3/4" wide may be used.
- E. Other Framing (Horizontal and Vertical Surfaces)
 - 1. Gun. Hi-Rib Lath: Attach with hog rings or 18 gage tie Wire. Attachments must engage one or more wire in the lath and encircle or attach to the flange or face of the support at no more than 6" o.c.
 - 2. Pyro K-Lath or Stucco Rite: Attach with self tapping screws with Neoprene washers. Attachments must engage one or more wires in the lath and attach to the flange or face of the support at not more than 6" o.c. On vertical surfaces position fastener below and engage horizontal wire in lath.
- F. Metal Trim
 - 1. Where Stucco terminates against dissimilar materials, install casing beads.
 - 2. Install expansion joints in the stucco and plaster fields as indicated, or. Where not indicated, install joints to create panels no larger than 144 square feet with no dimension exceeding 12 feet, or a length to width ratio of 2 to 1.
 - 3. Fasten metal trim by wire-tying or nailing depending on the type. style and hack-up collateral material.
 - 4. When used with metal lath. wire ties must be used. Install trim with attachment only to the edges of abutting sheets of lath. so that the lath is not continuous or tied across the joint.
 - 5. Where expansion joints are placed parallel to framing members, install joints so that none is more than 4" away from a framing member.

3.3. NUMBER OF COATS AND THICKNESSE

- A. Veneer/ Skim Coat Stucco: 2 coats, approximately 1/8 inch, or as required to cover substrate texture and provide for texture as selected.
- B. Over Cementitious Substrates: 3 coats. 3/8 inch leveling coat over a properly applied liquid bond agent, a 3/8" brown coat, with a 1/8 inch finish coat in color and texture specified - total minimum thickness of 7/8 inch.
- C. Over Lathed Wood Framing Systems: 3 coats. 7/8 inch thick.
- D. All thickness specified above and shown on Drawings are minimum thicknesses – not "average" thicknesses. If CM or Architect should decide to require that this contractor provide core samples as proof of any Work specified in this section. And any thickness turn out not be the minimums specified or shown. CM or Architect may require removal and replacement of any portion or all of the stucco or plaster plus any subsequently installed/applied finish material. No additional compensation and no additional construction time will be granted.

3.4. APPLICATION

- A. Apply scratch coat over metal lath with sufficient pressure so that it is shoved through the metal reinforcement against the backing to form full keys and to embed completely the reinforcement. Apply to an approximate thickness of 3/8" from the face of the backing. Scratch to provide bond for succeeding coat. Cure with water for minimum of 72 hours. This timing may require attendance over weekends and/or holidays, and if so, provide such additional Work at no additional cost to Owner.
- B. Apply brown coat not sooner than 72 hours after the application of the scratch coat. Dampen scratch coat evenly to obtain uniform suction. Apply to an approximate thickness of 3/8". Bring surface to a true, even surface by floating or rodding and leave rough, ready to receive finish coat. Cure with water for minimum of 7 calendar days.
- C. Where indicated over concrete or masonry that is not detailed to receive a metal lath over building paper, apply brown coat directly over concrete or masonry, proportioned as specified above. Dampen surface evenly to obtain uniform suction. Apply to an approximate thickness of 3/8". Bring surface to a true, even surface by floating or rodding, and leave rough and ready to receive finish coat. Cure for 7 days by keeping moist.
 - 1. Where there are control or expansion type joints in the masonry, ensure that there are joints installed in the plaster/stucco system over the same joint location.
- D. Apply finish coat not sooner than 7 days after the application of the preceding coat. Before applying, dampen the surface of the preceding coat evenly to obtain uniform suction. The thickness of the finish coat shall be sufficient to secure the texture specified, but in no case less than 1/8". Avoid excessive troweling. When applying the finish, plan work so that the entire wall can be completed at one time to eliminate joining marks. If not practical, use a corner, door or window as a breaking point. Texture and color of finish coat shall match approved sample.
- E. Upon completion, ensure that staging and vertical layering of applied plaster/stucco is not visible. It shall not be possible to see any vertical breaks on walls. All plaster work shall be continuous, regardless of wall height, except for prefabricated control joints and reveals.
- F. Terminate plaster/stucco systems where indicated on Drawings. If not dimensioned, consult with Architect to locate the termination properly.

1. Over masonry and other cementitious construction systems, terminate plaster/stucco systems at construction/control/expansion joint locations.

3.5. JOINTING

- A. As work progresses, build in expansion/contraction joints as shown on Drawings. If not detailed on Drawings, place as recommended by Plastering Institute, but gain Written approval from Architect on their exact suggested location prior to installation. In general, place expansion joints using the following guidelines:
 1. No area shall be greater than 144 square feet.
 2. No dimension shall be greater than 12 feet.
 3. No area shall have one dimension greater than twice the perpendicular dimension of the area.
- B. It shall be the final responsibility of the installing contractor to install proper types of joints in proper locations as recommended by the Plastering Institute, whether any further direction is given by Architect or not.
 1. Contractor assumes all financial responsibility for removal and replacement of lath and plaster systems which develop cracks as a result of not installing expansion/contraction joints.

3.6. CURING

- A. Keep each coat of plaster damp for at least 72 hours after application. Moistening of each coat shall begin as soon as the plaster has hardened sufficiently so as not to be injured. Apply water in a fine fog spray. Avoid soaking the plaster. Apply only as much Water as can be readily absorbed. Protect plaster from uneven and excessive evaporation during hot, dry weather and from strong wind.

3.7. PATCHING

- A. Plaster containing cracks, blisters, pits or discoloration will not be acceptable. Remove such plaster and replace with plaster conforming to the requirements of these specifications. Patching inherently defective work will be permitted only when approved and such patching shall match existing work in texture and colors. Repair all defects after other trades have finished their work.

END OF SECTION 09 24 00

**SECTION 09 29 00
GYPSUM BOARD****PART 1 - GENERAL****1.1 SCOPE:**

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the Contract, including but not limited to these major items:

1. Gypsum drywall construction.
2. Cementitious backer board construction
3. Joint and corner reinforcing, adhesive, tape and finishing.
4. Drywall & backer board accessories.
5. Access panels.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Wood framing for drywall: Section 06 10 00
- B. Metal stud framing for backer board: Section 05 40 00
- C. Insulation. Section: 07 21 00
- D. Furnishing access panels required for access to mechanical and electrical equipment, for installation under this Section.

1.3 GENERAL REQUIREMENTS:

- A. Field Conditions. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report to the Architect all conditions which prevent proper execution of this work.
- B. Codes. Materials and work shall conform to the governing Building Code. In case of conflict between these specifications, the Reference Specifications and the Building Code, the more stringent shall govern.
- C. Reference Specifications. Except as may be modified by these specifications and applicable laws and ordinances at the place of building, install this work to conform to the requirements of "Standard Specifications for Gypsum Wallboard Interior Finishes", as approved by the American National Standards Institute as ANS #A97.1.
- D. Approved Manufacturers. United State Gypsum Co., Blue Diamond Co., National Gypsum Co., or Kaiser Gypsum Co., Inc.
- E. Delivery and Storage. Deliver all materials in unbroken packages bearing manufacturer's brand name and designation. Keep materials dry and protected from the weather. Take care to avoid damage to edges, ends, and surfaces.

1.4 FASTENERS:

- A. Space fasteners at 12" O.C. in the field and 8" O.C. staggered along abutting edges, or closer as stated on plans & details. While fasteners are being driven, hold the wallboard in firm contact with the underlying support. Proceed from the central portion of the wallboard toward ends and edges, using power screwdriver recommended by the wallboard manufacturer to drive screws. Drive home with heads slightly below wallboard

surface in a dimple formed by the fastener's head. Take care to avoid breaking the paper face. Place fasteners not closer than 3/8" from ends or edges of wallboard.

1.5 JOINT TREATMENT:

- A. Field Joints. Apply a 3" wide uniform coating of adhesive centered over the joint; center tape over the joint and embed into the adhesive. Allow to dry and sand smooth. Apply two coats of adhesive over the tape, extending each coat slightly beyond the preceding one. Allow each coat to dry and sand smooth. Treat screw dimples in a like manner.
- B. Inside Angles. Treat inside corners and angles as for field joints, except fold the tape in the middle to provide a clean sharp corner, fully embedded.
- C. Outside Angles. Use metal corner beads and accessories standard with the wallboard manufacturer set in and finished with adhesive as for joints.
- D. Intersections with other Materials. Where gypsum abuts concrete and other material, trim edge with U.S.G. No. 401 metal trim.

1.6 MECHANICAL AND ELECTRICAL WORK:

- A. Coordinate with Mechanical and Electrical trades in the location and installation of their work. Provide bridging, bracing and backing to support their work installed in or on drywall construction. Do not close both faces of walls until their installations have been inspected and approved.

1.7 ACCESS PANELS:

- A. Access panels for access to plumbing chases which occur in drywall partitions or furring will be furnished to the job under this section. Locate panels where directed by Architect and install level and square with adjacent construction.

1.8 SUBMITTALS

- A. Submit product shop drawings and data to the architect for review. Refer to specification Section 01 34 00 for additional requirements.

PART 2 - MATERIALS

2.1 GYPSUM WALLBOARD:

- A. Minimum 5/8" high impact resistant thickness tapered edge sheet conforming to ASTM C36; thicknesses indicated. Use Type W/R, conforming to ASTM C630 where noted.
- B. Joint reinforcing tape, adhesive and metal corner reinforcement: Standard products for water resistant gypsum board installations, as recommended by the manufacturer of the gypsum wallboard used in the work.

2.2 FASTENERS:

- A. Stainless steel screws, blued needlepoint nails, or other corrosion resistant fasteners for attachment of wallboard to wood studs.

2.3 ACOUSTICAL SEALANT:

- A. Non-drying, non-hardening, permanently flexible, synthetic rubber-based product - Soundcaulk 101, by Parr, Inc., Los Angeles, California; Tremco Manufacturing Co.,

Cleveland, Ohio; or other as approved by Architect.

2.4 REINFORCEMENT AT OPENINGS:

- A. Reinforce grillage with 3/4" cold rolled channels wire-tied on top of, and parallel to, main runners.

2.5 ACCESS PANELS:

- A. Milcor, Style DW, for general ceiling access; Style M stainless for plumbing access.

2.6 CORNER BEADS:

- A. Metal, G30 galvanized, square type for all interior applications. No prefinished type corner bead is acceptable. Where special wallboard is called for or used to inhibit mold, mildew, and bacteria growth, provide plastic corner bead.

2.7 EDGE TRIM:

- A. GA201 and GA216 galvanized metal. Where special wallboard is called for or used to inhibit mold, mildew, and bacteria growth, provide plastic corner bead.

2.8 JOINT MATERIALS:

- A. ANSI/ASTM C475 reinforcing tape, joint compound, adhesive, and water. Where special wallboard is called for or used to inhibit mold, mildew, and bacteria growth, provide fiberglass tape and appropriate water resistant and other special products.

2.9 CEMENT BOARD

- A. Cementitious Backer Panel (Durock Brand Cement Board with Edgeguard)
 - 1. Basis of Design: Subject to compliance with project requirements, the design is based on the following: USG Corporation, LLC, "USG Durock Cement Board".
 - 2. Classification: Cementitious Backer Units: ANSI A118.9, ASTM A108.11 and ASTM C 1325 provide with manufacturer's standard edges.
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Board Length: As required. Contractor to verify with field conditions.
 - c. Board Width: As required. Contractor to verify with field conditions.
 - d. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 3. Minimum bending radius: 6 feet (1830 mm).
 - 4. Fastener Requirements: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.
 - a. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: DUROCK Brand Steel or USG Sheathing SF steel drill screws (minimum 1-1/4 inch) with corrosion-resistant coating.
 - b. Wood Screws: DUROCK Brand Wood or USG Sheathing WF screws (minimum 1-1/4 inch with corrosion-resistant coating).
 - c. Nails: 11-gauge hot-dipped galvanized roofing nails (minimum 1-1/2 inch diameter head).
 - 5. Installation Requirements:
 - a. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.

- b. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.
- c. Joining: Use latex-fortified mortar or Type 1 organic adhesive and alkali-resistant, fiberglass mesh joint tape (USG Durock™ Brand Tile Backer Tape).
- d. Waterproofing: Use USG Durock™ Brand Liquid Waterproofing Membrane. Install per manufacturer's specifications.

PART 3 - EXECUTION

3.1 GYPSUM WALL BOARD APPLICATION:

- A. Cut gypsum wallboard by scoring and breaking or by sawing, working from the face side. Sand cut edges and ends where necessary to obtain neat joining when wallboard is erected. Score cutouts or small openings in wallboard in outline before knocking out or cut out with a saw; do not punch. Neatly scribe wallboard meeting projecting surfaces. Stagger joints in the board with abutting ends occurring over a support. To minimize end joints, use wallboard sheets of maximum practical lengths. Arrange joints on opposite sides of partition to occur on different studs. Apply with long dimension across supports, except where fire rating is required, apply long dimension vertically with joints located over stud edges.

3.2 CEMENTITIOUS BACKER BOARD APPLICATION:

- A. Install cement board with ends and edges closely abutted, but not forced together. Stagger end joints in successive courses.
- B. For wall application, fasten USG Durock® Brand Cement Board with EdgeGuard panels to framing with specified fasteners. Drive fasteners into field of panels first, working toward ends and edges. Hold panels in firm contact with framing while driving fasteners. Space fasteners maximum 8 in. (203 mm) o.c. for walls, 6 in. (152 mm) o.c. for ceilings, with perimeter fasteners at least 3/8 in. (10 mm) and less than 5/8 in. (16 mm) from ends and edges. Drive screws so bottoms of heads are flush with panel surface to ensure firm panel contact with framing. Do not overdrive fasteners. Approved fasteners include: USG Durock™ Brand Tile Backer Screws for steel framing (or equivalent), 1-1/4 in. (32 mm) and 1-5/8 in. (41 mm) for 14- to 20-gauge steel framing; USG Durock™ Brand Tile Backer Screws for wood framing (or equivalent), 1-1/4 in. (32 mm), 1-5/8 in. (41 mm) and 2-1/4 in. (57 mm) for wood framing. Nails (1-1/2 in. [38 mm] hot-dipped galvanized roofing nails). Prefill joints with tile-setting mortar or adhesive and then immediately embed USG Durock™ Brand Tile Backer Tape and level joints.
- C. Cement board should be cut to size with a knife and straight edge. A power saw should be used only if it is equipped with a dust-collection device. Installer should wear NIOSH/MSHA approved dust mask.
- D. Waterproofing: Use USG Durock™ Brand Liquid Waterproofing Membrane. Install per manufacturer's specifications.

END OF SECTION 09 29 00

**SECTION 09 30 00
TILING****PART 1 - GENERAL****1.1 SCOPE:**

- A. The extent of tile work is shown on drawings and in schedules.

1.2 QUALITY ASSURANCES:

- A. Provide tile equal to or exceeding Standard Grade requirements of ANSI A 137.1.
- B. When using setting and grouting materials manufactured under TCA license, provide such identification together with formula on each container.
- C. Provide materials obtained from only one source for each type and color of tile.
- D. Proprietary Materials. Handle, store, mix and apply proprietary setting and grouting materials in compliance with manufacturer's instructions.

1.3 SUBMITTALS:

- A. Manufacturer's Data. Submit six (6) copies of manufacturer's specifications and installation instructions for all materials required, except bulk materials. Include certifications and other data as may be required to show compliance with these specifications. Indicate by transmittal that a copy of each instruction has been distributed to the installer.
- B. Samples. Submit six (6) samples of each type, class and color of tile required. Architect's review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.4 DELIVERY AND STORAGE:

- A. Deliver materials and store on site in original containers with seals unbroken and labels intact until time of use.

PART 2 - MATERIALS**2.01 FLOOR TILE:**

- A. Provide tile by Daltile or approved equal.
 - 1. Public Restrooms: 2x2 Keystones Mosaics Tile
 - 2. Food service Kitchen areas (including associated restroom, Janitor's Room, hallway, serving areas, and storage areas: 6x6 Paver Tiles
 - 3. Lobbies: Stratford Place 18" square.
- B. Refer to the finish schedule on the architectural plans for locations, size, and recommended colors, etc. Final tile size and color selection shall be made by City staff from the manufacturer's full range of colors.
- C. All tile shall be slip resistant to comply with CBC and ADA requirements.

- D. Provide corner tiles at all corners, other typical trim tiles, and other special tiles typically provided.

2.1 COVED TILE BASE:

- A. Provide tile by Daltile or approved equal.
 - 1. Public Restrooms: 2x2 Keystone Mosaic Tiles
 - 2. Food Service Kitchen areas (including associated restroom, Janitor's Room, hallway, serving areas, and storage areas: 6x6 Paver Tiles
- B. Refer to the finish schedule on the architectural plans for locations, size, and recommended colors, etc. Final tile size and color selection shall be made by City staff from the manufacturer's full range of colors.
- C. All tile shall be slip resistant to comply with CBC and ADA requirements.
- D. Coved tile base shall have "min. 3/8" cove.
- E. Provide corner tiles at all corners, other typical trim tiles, and other special tiles typically provided.

2.2 WALL TILE:

- A. Provide tile by Daltile or approved equal.
 - 1. Restrooms: 4x4 Semi-Gloss Wall Tiles as noted in the Finish Schedule on the drawings.
 - 2. Public Restrooms: 2x2 Keystone Mosaics Blend Accent Wall Tiles.
- B. Refer to the finish schedule on the architectural plans for locations, size, and recommended colors, etc. Final tile size and color selection shall be made by City staff from the manufacturer's full range of colors.
- C. All tile shall be slip resistant to comply with CBC and ADA requirements.
- D. Provide corner tiles at all corners, other typical trim tiles, and other special tiles typically provided.

2.3 EPOXY MORTAR AND GROUT MATERIALS:

- A. Comply with ANSI A 108.6 and A 118.3 for materials and installation specification.

2.4 GROUT:

- A. Provide colored grout matching tile in color and one shade darker. Verify with City staff.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Installer must examine the areas and conditions under which tile work is to be

installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of this work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION:

- A. The contractor shall provide all required floor preparation for a complete installation including all required substrate sealer, water proofing, floating/leveling and anything else required for a complete installation.
- B. Comply with ANSI standard installation specifications A 108.1 and Tile Council of America "Handbook for Ceramic Tile Installation", except as otherwise shown or specified. Maintain minimum temperature limits and installation practices as recommended by mortar and grout materials manufacturers.
- C. Extend tile work into recesses and under equipment and fixture to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignments.
- D. Comply with manufacturer's instructions for mixing and installation of proprietary materials.
- E. Neutralize and seal substrates in accordance with mortar or adhesive manufacturer's instructions, as required.
- F. Setting: Tile installation to be by the Portland Cement Mortar Methods for horizontal and vertical surfaces per specifications F 111-98 and W231-98, respectively, as shown in the "Handbook for Ceramic Tile Installation".
- G. Floating: All floor tile needs to be floated to achieve slopes to floor drains. All tile floors and walls in showers shall be waterproofed and floated. Refer to the Tile Council of America Handbook for Ceramic Tile Installation and other industry standards for appropriate conditions and requirements.
- H. Waterproofing: All tile floors and walls in restrooms, janitor's rooms, and catering kitchen areas shall be waterproofed. Provide an approved liquid applied or sheet shower pan waterproof membrane at all tile shower floors and walls. Refer to the Tile Council of America Handbook for Ceramic Tile Installation and other industry standards for appropriate conditions and requirements.

3.3 JOINTING PATTERN:

- A. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.

3.4 PLACEMENT:

- A. Comply with applicable requirements of ANSI A 108.1 for installation of Portland cement mortar set tile. Use commercial cement grout for grouting tile wall joints, unless otherwise shown.

3.5 CLEANING:

- A. Upon completion of placement and grouting, clean tile installations as recommended by TCA and manufacturers of proprietary materials.

- B. Tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than ten (10) days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush the surface with clean water before and after cleaning.

3.6 FINISHED TILE WORK:

- A. Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

3.7 PROTECTION:

- A. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage and wear.

END OF SECTION 09 30 00

**SECTION 09 65 00
RESILIENT FLOORING & BASE**

PART I – GENERAL

1.1 WORK INCLUDED

- A. 12" Square Vinyl Cement Tile
- B. 4" Rubber Coved Base
- C. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
- D. Related Documents: Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section

1.2 RELATED WORK

- A. 09 29 00 - Gypsum Wallboard Systems.
- B. Other Division 9 sections for floor finishes related to this section but not the work of this section
- C. Division 3 Concrete; not the work of this section
- D. Division 6 Wood and Plastics; not the work of this section
- E. Division 7 Thermal and Moisture Protection; not the work of this section

1.3 REFERENCE STANDARDS

- A. Armstrong Flooring Technical Manuals
 - 1. Armstrong Flooring Guaranteed Installation Systems manual, F-5061
 - 2. Armstrong Flooring Maintenance Recommendations and Procedures, manual, F-8663
- B. ASTM International:
 - 1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
 - 5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
 - 6. ASTM F 1861 Standard Specification for Resilient Wall Base
 - 7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

- C. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials
- D. All exposed materials provided under this section of specifications shall have a flame spread rating of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84. Provide evidence of such prior to ordering such products or materials.

1.4 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.
- B. Administrative Requirements
 - 1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
 - 2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e. moisture tests, bond test, pH test, etc)]
- C.
- D. Test Installations/ Mock-ups: Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
 - 1. Mock-Up Size: 4'-0"x4'-0"
 - 2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 3. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.
- E. Sequencing and Scheduling
 - 1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
 - 2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.5 SUBMITTALS

- A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061) for flooring and accessories.
- B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.

- C. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.
- D. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
- E. Closeout Submittals: Submit the following:
 - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 - 2. Warranty: Warranty documents specified herein

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
- B. Select an installer who is experienced and competent in the installation of Armstrong resilient vinyl composition tile flooring and the use of Armstrong Flooring subfloor preparation products.
 - 1. Engage installers certified as Armstrong Commercial Flooring Certified Installers
 - 2. Confirm installer's certification by requesting their credentials
- C. Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
 - 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
 - 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
 - 3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.

1.7 PROJECT CONDITIONS

- A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of [100°F (38°C)][85°F (29°C)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to the Armstrong Flooring Guaranteed Installations Systems manual, F-5061 for a complete guide on project conditions.

1.8 LIMITED WARRANTY

- A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- B. Limited Warranty Period: 5 years
- C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent

with other warranties made by the Contractor under the requirements of the Contract Documents.

- D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

1.9 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.
1. Quantity: Furnish quantity of flooring units equal to 1% of amount installed (minimum of 100 square feet).
 2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra material.

PART II – PRODUCTS

2.1 MANUFACTURER

- A. Resilient tile flooring, wall base, adhesives and subfloor preparation products and accessories:

Armstrong Flooring Inc., 2500 Columbia Avenue, Lancaster, PA 17604,
www.armstrongflooring.com/commercial

1. Manufacturer must have a headquarters in the United States of America

2.2 PRODUCT SUBSTITUTION

- A. Substitutions: "Or Equal" or "Approved Equal" products allowed per Specification Section 01 60 00.

2.3 RESILIENT TILE FLOORING MATERIALS

- A. Provide Vinyl Composition Tile: Standard Excelon® Imperial® Texture Tile Flooring manufactured by Armstrong Flooring, Inc.
1. Description: Tile composed of polyvinyl chloride resin, plasticizers, fillers, stabilizers and pigments with colors and texture dispersed uniformly throughout its entire thickness.
 2. Vinyl composition tile shall conform to the requirements of ASTM F 1066, "Standard Specification Vinyl Composition Floor Tile", Class 2, through-pattern
 3. Pattern and Color: To match existing floor tile. To be verified by the contractor in the field
 4. Size: 12 in. x 12 in. (305 mm x 305 mm)
 5. Thickness: 1/8"/0.125 in. (3.2mm)

2.4 WALL BASE MATERIALS

- A. For top set wall base: To match existing material & profile. To be verified by the contractor in the field.
- B. Color: To match existing. To be verified in the field by the contractor.

2.5 ADHESIVES

- A. For Tile Installation System, Full Spread: Provide Armstrong S-515 Floor Tile Adhesive under the tile and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.
- B. For Tile High-Moisture Installation Warranty, Full Spread: Provide Armstrong S-515 Floor Tile Adhesive under the tile and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.

2.6 ACCESSORIES

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide one or more of the following:
 - 1. Armstrong S-184 Fast-Setting Cement-Based Patch and Underlayment
 - 2. Armstrong S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive
 - 3. Armstrong S-453 Level Strong™ cement based self-leveling compound
 - 4. Armstrong S-456 Patch Strong™ flexible patching and smoothing compound.
- B. For priming porous substrates to aid in adhesive bond strength and reducing subfloor porosity, provide S-454 Prime Strong™ acrylic primer for porous substrates. For non-porous substrates, provide S-455 Prime Strong™ acrylic primer for non-porous substrates.
- C. For creating a moisture barrier, provide S-452 Seal Strong™ two part moisture mitigation system.
- D. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- E. Provide transition/reducing strips tapered to meet abutting materials.
- F. Provide threshold of thickness and width as shown on the drawings.
- G. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
- H. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART III – EXECUTION

3.1 SITE AND SUBSTRATE CONDITIONS

- A. Ensure that wall surfaces are smooth, and reasonably flat And level to ensure proper adhesion to substrates.

- B. Ensure that areas to receive resilient base are well lit during applications.

3.2 TESTING FOR CONCRETE MOISTURE CONDITIONS

- A. Concrete shall be fully cured and dry. Concrete shall have low permeability.
- B. Conduct the following test on concrete to receive VCT floor products: ASTM F1869. Results shall show no more than 3 pounds of water per L000 square feet in 4 hours. This result shall be provided regardless if floor product manufacturer accepts more than 3 pounds of water.
- C. The contractor shall be responsible for all floor substrate preparation including patching, grinding, floating, and sealing all floor areas to receive VCT flooring to obtain the optimum installation conditions required by the flooring manufacturer's specifications.

3.3 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.4 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.).
- B. Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.
- C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.5 PREPARATION

- A. Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring S-184 Fast-Setting Cement-Based Patch and Underlayment, S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive, S-453 Level Strong™ cement based self-leveling compound, S-456 Patch Strong™ flexible patching and smoothing compound, S-454 Prime Strong™ acrylic primer for porous substrates, and/or S-455 Prime Strong™ acrylic primer for non-porous

substrates as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

- B. Subfloor Preparation Moisture Mitigation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, mitigate moisture and other defects with Armstrong Flooring S-184 Fast-Setting Cement-Based Patch and Underlayment, S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive, S-453 Level Strong™ cement based self-leveling compound, S-456 Patch Strong™ flexible patching and smoothing compound, S-452 Seal Strong™ two part moisture mitigation system, S-454 Prime Strong™ acrylic primer for porous substrates, S-455 Prime Strong™ acrylic primer for non-porous substrates as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.
- C. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material.. Refer to the Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.
- D. For Tile Installation System, Full Spread when using S-700 or S-750 adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes" or ASTM F 1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems manual, F-5061, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 80%. MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.
- E. For Tile High-Moisture Installation Warranty when using S-515 Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes" or ASTM F 1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems manual, F-5061, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 95%. MVER shall not exceed 7 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for

both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

- F. For Tile High-Moisture Installation Warranty when using S-525 Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes" or ASTM F 1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems manual, F-5061, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 90%. MVER shall not exceed 7 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.
- G. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

3.6 INSTALLATION OF FLOORING

- A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061. Failure to comply may result in voiding the manufacturer's warranty listed in Section 1.08.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.7 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- D. Apply butt-type or overlap metal edge strips where shown on the drawings, before flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.8 CLEANING.

- A. Perform initial and on-going maintenance according to the latest edition of the maintenance recommendations for Standard Excelon Imperial Texture.
- B. Remove excess adhesive from surfaces without damage to flooring
- C. Contiguous surfaces and materials.
 - 1. Clean surfaces in accordance with manufacturers printed recommendations.
- D. Leave replacement materials equaling approximately 3 percent of base material installed, and one full gallon of adhesive.

3.9 PROTECTION

- A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing The Job in the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061.)

END OF SECTION 09 65 00

**SECTION 09 77 00
FIBERGLASS REINFORCED PLASTIC PANELS**

PART 1- GENERAL

1.1 SECTION INCLUDES:

- A. Fiberglass reinforced polyester panel system for adhesive mounting.
- B. Moldings, adhesive, and joint sealants.

1.2 RELATED SECTIONS:

- A. Gypsum Drywall (see drawings)
- B. Section 09 91 13 & 09 91 23 - Painting

1.3 REFERENCES:

- A. ANSI/AHA A135.5 - Prefinished Hardboard Paneling.
- B. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- C. ASTM D 523 - Standard Test Method for Specular Gloss.
- D. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
- E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- F. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer.
- G. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- H. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
- I. ASTM D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
- J. ASTM D 1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- K. ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- L. ASTM D 2197 - Standard Test Methods for Adhesion of Organic Coatings by Scrape Adhesion.
- M. ASTM D 2486 - Standard Test Method for Scrub Resistance of Wall Paints.
- N. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- O. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS:

- A. Submit 6 sets of the following:
- B. Product Data: Manufacturer's data sheets on each product to be used, including:

Preparation instructions and recommendations.
Storage and handling requirements and recommendations.
Installation methods.

Selection Samples: For each finish specified, six complete sets of color chips representing manufacturer's full range of available colors and patterns.

- C. Maintenance Instructions: Deliver to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

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

Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS**2.1 MANUFACTURERS:**

- A. Acceptable Manufacturer: Marlite; 202 Harger Street, Dover, OH 44622. ASD.
Tel: (330) 343-6621. Fax: (330) 343-7296.
Email: info@marlite.com
www.marlite.com
- B. Substitutions: or approved equal.
- C. Requests for substitutions will be considered in accordance with provision of Section 01 60 00.

2.2 APPLICATIONS

Provide plastic paneling in Plumbing Chase behind Janitor's Sink as shown on the plans & finish schedule.

2.3 PANEL SYSTEM

Plastic Panel System: Factory finished panels, trim, sealant, and accessories.

Panels: Marlite FRP Panels; fiberglass reinforced polyester, USDA approved for incidental food contact.

- 1. Thickness: 3/32 inch (2.4 mm), nominal.
- 2. Width: 48 inches (1220 mm).
- 3. Height: 108 inches (2743 mm) (where indicated on plans)
- 4. Height: 120 inches (3048 mm) (where indicated on plans)

5. Surface Burning Characteristics: Flame spread index of 200 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84 (Class C/III).
6. Flexural Strength: 17,000 psi (117 MPa), when tested in accordance with ASTM D 790.
7. Flexural Modulus: 600,000 psi (4137 MPa), when tested in accordance with ASTM D 790.
8. Tensile Strength: 8,000 psi (55 MPa), when tested in accordance with ASTM D 638.
9. Tensile Modulus: 9,430 psi (65 MPa), when tested in accordance with ASTM D638.
10. Barcol Hardness: 40, when tested in accordance with ASTM D 2583.
11. Impact Resistance: 7 ft-lb/in (1225 N/m), when tested in accordance with ASTM D 256, Izod method.
12. Coefficient of Thermal Expansion: 0.0000157 in/in/degree F (0.0000283 mm/mm/degree C), measured in accordance with ASTM D 696.
13. Water Absorption: 0.17 percent, when tested in accordance with ASTM D 570.
14. Specific Gravity: 1.53, when tested in accordance with ASTM D 792.
15. Surface Texture: High-gloss, smooth.
16. Color: White

Panel Trim: Extruded PVC, in manufacturer's standard colors. Outside corners, inside corners, edge trim, and division molding.

Base Molding: Design that simplifies installation and helps seal wall panel system, with factory made corners and splices

Sealant: Marlite Silicone Sealant; gunnable silicone rubber.
1. Color: to be selected by Architect to match panel color

PART 3 - EXECUTION

3.1 EXAMINATION

Do not begin installation until substrates have been properly prepared.

If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours prior to installation.

Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

Clean surfaces thoroughly prior to installation.

Protect existing surfaces from damage due to installation.

3.3 INSTALLATION

Install in accordance with manufacturer's instructions.

Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of

alternative adhesives.

Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch (3 mm) expansion space.

Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.

END OF SECTION 09 77 00

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates listed in part, 3.6 Exterior Painting Schedule.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 35 units at 85 degrees, according to ASTM D 523
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.
- H. EG: Ethylene Glycol. Ethylene glycol is listed as a hazardous air pollutant (HAP) by the U.S. EPA.
- I. Blocking: Two painted surfaces sticking together such as a painted door sticking to a painted jamb.
- J. RAVOC: Reactivity adjusted VOC 'Reactivity' means the ability of a VOC to promote ozone formation.
- K. PDCA: Painting & Decorating Contractors of America www.pdca.org
- L. SSPC: Scopes of SSPC Surface Preparation Standards and Specifications.

www.sspc.org.

- M. Green Wise: Green Wise products are tested in an ISO accredited laboratory to meet environmentally determined performance standards established by Coatings Research Group, Inc.
- N. Dunn-Edwards Conformance Chart: [DE CONFORMANCE TABLE](#)

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, no smaller than 7 inches by 10 inches (177.8 mm by 254 mm) or larger than 8.5 inches by 11 inches (215.9 mm by 279.4 mm).
 - 2. Label each Sample for project, architect, general contractor, painting contractor, paint color name and number, paint brand name, "P" number if applicable, and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: Provide not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C) or more than 120 degrees F (49 degrees C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 90 degrees F (10 and 32 degrees C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- C. Painting contractor should follow proper painting practices and exercise judgment based on his or her experience and project specific conditions as to when to proceed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Provide products listed from Dunn-Edwards Corporation
 - 1. Contact: Kim Hampton Architectural Services Representative,
Cell: 949-576-8835,
email: kim.hampton@dunnedwards.com

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited.
- D. Colors: To be selected by City staff from full product color range
 - 1. Indicate a percentage of the surface area that will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will comply with requirements to use compatible products and systems as described in Paragraph 2.2.A. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Portland Cement Plaster: 12 percent.
 5. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured, including pH testing to determine that alkalinity is within limits established by the manufacturer.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- F. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- G. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- H. Shop Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.
- I. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- J. Aluminum Substrates: Remove loose surface oxidation.
- K. Wood Substrates:
 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied at no additional cost to the Owner, to completely hide base material, provide uniform color, and to produce satisfactory finish results.
 3. Apply coatings without thinning except as specifically required by label directions or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
 4. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 5. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.

6. Paint entire exposed surface of window frames and sashes.
 7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 8. Priming may not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required ensuring an even primed surface before applying finish coat.
- B. Tint each undercoat to a lighter shade of the finish coat (not to exceed 2 ounces of colorant) to facilitate identification of each coat if multiple coats of same material are to be applied.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Block Fillers: Provide block fill as scheduled to conform to the following: PDCA Standard P12-05.
1. Level 3 - Premium fill: One or multiple coats of high-performance block filler manufactured to be applied at a high dry film build. Block filler shall be back rolled to eliminate voids and reduce the majority of the masonry profile depth.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Other items as directed by the Architect.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by

washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Non-Traffic Surfaces:

- 1. Premium Latex System:
 - a. Prime Coat: Primer, alkali resistant, waterbased, interior/exterior, Dunn-Edwards, Eff-Stop Select [ESSL00](#).
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat, Dunn-Edwards, Spartashield [SSHL10](#) 100% acrylic, (Gloss Level 1).

B. Clay-Masonry, CMU (without block filler) Substrates:

- 1. Premium Latex System:
 - a. Prime Coat: Primer, alkali resistant, waterbased, interior/exterior Dunn-Edwards, Eff-Stop Select [ESSL00](#).
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat, Dunn-Edwards, Spartashield [SSHL10](#) 100% acrylic, (Gloss Level 1).

C. CMU Substrates:

- 1. Premium Latex System:
 - a. Prime Coat: Block filler, latex, interior/exterior, Dunn-Edwards, Smooth BLOCFIL Select [SBSL00](#).
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior flat, Dunn-Edwards, Spartashield [SSHL10](#) 100% acrylic, (Gloss Level 1).

D. Steel Substrates:

- 1. Waterborne Urethane Alkyd Enamel System:
 - a. Prime Coat: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Enduraprime Rust Preventative Primer [ENPR00](#).
 - b. Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
 - c. Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield [ASHL50](#), (Gloss Level 5)

E. Galvanized Metal Substrates:

- 1. Waterborne Urethane Alkyd Enamel over a Latex Primer System:
 - a. Prime Coat: Primer, waterbased, interior/exterior, Dunn-Edwards Ultrashield Galvanized Metal Primer [ULGM00](#).
 - b. Intermediate Coat: Waterborne urethane alkyd, interior/exterior, matching topcoat.
 - c. Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss,

Dunn-Edwards Aristoshield [ASHL50](#), (Gloss Level 5)

F. Aluminum Substrates:

1. Waterborne Urethane Alkyd Enamel over a Latex Primer System:
 - a. Prime Coat: Primer, waterbased, interior/exterior, Dunn-Edwards, Ultrashield Galvanized Metal Primer [ULGM00](#).
 - b. Intermediate Coat: Waterborne urethane alkyd, interior/exterior, matching topcoat.
 - c. Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield [ASHL50](#), (Gloss Level 5)

G. Wood Substrates:

1. Premium Latex System:
 - a. Prime Coat: Primer, waterbased, exterior, Dunn-Edwards, EZ-Prime Premium [EZPR00](#).
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat, Dunn-Edwards, Spartashield [SSHL10](#) 100% acrylic, (Gloss Level 1).

H. Portland Cement Plaster (Stucco) Substrates:

1. Ultra-Premium Acrylic Elastomeric System (at all locations to receive a smooth trowel plaster finish):
 - a. Prime Coat: Primer, alkali resistant, waterbased, interior/exterior, Dunn-Edwards, Eff-Stop Select [ESSL00](#).
 - b. Intermediate Coat: Acrylic, exterior, matching topcoat.
 - c. Topcoat: Acrylic, exterior, flat, Dunn-Edwards, Enduralastic 10 [EDLX10](#) 100% acrylic, (Gloss Level 1).
 - d. Final Topcoat: Topcoat: Latex, exterior, flat, Dunn-Edwards, Evershield [EVSH10](#) 100% acrylic, (Gloss Level 1).
2. Premium Latex over Alkali Resistant Primer System (at locations NOT requiring an elastomeric paint finish):
 - a. Prime Coat: Primer, alkali resistant, waterbased, interior/exterior, Dunn-Edwards, Eff-Stop Select [ESSL00](#).
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat, Dunn-Edwards, Spartashield [SSHL10](#) 100% acrylic, (Gloss Level 1).

END OF SECTION 09 91 13

**SECTION 09 91 23
INTERIOR PAINTING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates listed in 3.6 Interior Painting Schedule.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 1 to 2 units at 85 degrees.
- B. Gloss Level 2: 5 to 9 units at 60 degrees and 10 to 15 units at 85 degrees.
- C. Gloss Level 3: 10 to 15 units at 60 degrees and 15 to 30 units at 85 degrees.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and 35 to 50 units at 85 degrees.
- E. Gloss Level 5: 40 to 50 units at 60 degrees.
- F. Gloss Level 6: 70 to 80 units at 60 degrees
- G. Gloss Level 7: More than 80 units at 60 degrees.
- H. Blocking: Two painted surfaces sticking together such as a painted door sticking to a painted jamb.
- I. Mildew Resistant: Certified products are specially formulated with microbicidal additives that resist mold, mildew, and algae growth on the paint film and inhibit growth of bacterial odors.
- J. CHPS: Collaborative for High Performance Schools. A national movement to improve student performance and the entire educational experience by building the best possible schools. www.chps.net.
- K. EG: Ethylene Glycol. Ethylene glycol is listed as a hazardous air pollutant (HAP) by the U.S. EPA.
- L. PDCA: Painting & Decorating Contractors of America www.pdca.org .
- M. RAVOC: Reactivity adjusted VOC. "Reactivity" means the ability of a VOC to promote ozone formation
- N. SSPC: The Society for Protective Coatings publishes Scopes of SSPC Surface Preparation Standards and Specifications www.sspc.org .

- O. Dunn-Edwards Conformance Chart: D-E CONFORMANCE TABLE

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. LEED v.4 Requirements: Interior paints and coatings must pass CDPH Standard Method V1.1 (also called section 01350) emissions testing; and they must comply with the VOC content limits of the California ARB 2007 Suggested Control Measure for Architectural Coatings.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, no smaller than 7 inches X 10 inches (177 mm X 254 mm) or larger than 8.5 inches X 11 inches (216 mm X 280 mm).
 2. Label each Sample for project, architect, general contractor, painting contractor, paint color name and number, paint brand name, "P" number if applicable, and application area.
- E. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: Provide not less than 1 gal. (3.8L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 90 degrees F (10 and 32 degrees C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- C. Painting contractor should follow proper painting practices and exercise judgment based on his or her experience and project specific conditions as to when to proceed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Provide products listed from the Dunn-Edwards Corporation.
 - 1. Contact: Kim Hampton Architectural Services Representative, Cell: 949-576-8835, email: kim.hampton@dunnedwards.com

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide material that comply with VOC limits of authorities having jurisdiction.
- C. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited and zero VOC colorants should be used whenever possible.
- D. Colors: As selected by City staff from full product color range.
 - 1. Indicate a percentage of surface area which will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove

noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will comply with requirements to use compatible products and systems as described in Article 2.2. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
 - 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured, including pH testing to determine that alkalinity is within limits established by the manufacturer.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted

exceeds that permitted in manufacturer's written instructions, including pH testing to determine that alkalinity is within limits established by the manufacturer.

- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.
- H. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
Use applicators and techniques suited for paint and substrate indicated
 - 1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 2. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat to a lighter shade of the finish coat (not to exceed 2 ounces of colorant) to facilitate identification of each coat if multiple coats of same material are to be applied.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- E. Block Fillers: Provide block fill as scheduled to conform to the following PDCA Standard P12-05:
 - 1. Level 3 - Premium Fill: One or multiple coats of high-performance block filler manufactured to be applied at a high dry film build. Block filler shall be back rolled to eliminate voids and reduce the majority of the masonry profile depth.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - i. Other items as directed by the architect.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by the Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

- 1. Waterborne Urethane Alkyd Enamel System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, Dunn-Edwards, Enduraprime Rust Preventative Primer ENPR00.
 - b. Intermediate Coat: Waterborne urethane alkyd matching topcoat.
 - c. Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5)

B. Galvanized Metal Substrates:

- 1. Waterborne Urethane Alkyd Enamel over a Latex Primer System:
 - a. Prime Coat: Primer, waterbased, Dunn-Edwards, Ultrashield Galvanized Metal Primer ULGM00.
 - b. Intermediate Coat: Waterborne urethane alkyd matching topcoat.
 - c. Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

C. Aluminum (Not Anodized or Otherwise Coated) Substrates:

- 1. Waterborne Urethane Alkyd Enamel over a Latex Primer System:
 - a. Prime Coat: Primer, waterbased, Dunn-Edwards, Ultrashield Galvanized Metal Primer ULGM00.
 - b. Intermediate Coat: Waterborne urethane alkyd matching topcoat.
 - c. Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5)

D. Wood Substrates:

- 1. Premium Low Odor/VOC Latex System:
 - a. Prime Coat: Primer, latex, for interior wood, Dunn-Edwards, Decoprime DCPR00.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, Dunn-Edwards, Spartawall SWLL50, (Gloss Level 5)."Institutional Low-Odor/VOC Latex System" Subparagraph below corresponds to MPI INT 6.1Q, MPI INT 6.2L, MPI INT 6.3V, and MPI INT 6.4T.
- 2. Waterborne Low Oder/VOC Stain System: Stage/Platform Floor and Interior Doors.
 - a. Stain Coat: Old Masters Penetrating Stain
 - b. Clear Coat: Old Masters Masters Armor Interior Water-Based Satin 721 Clear Finish, or
 - c. Clear Coat: Old Masters Masters Armor Interior Water-Based Semi-Gloss 722 Clear Finish
 - d. Clear Coat Additive: Old Masters Masters Armor Part B Hardener

E. Gypsum Board Substrates: All walls and ceilings Eggshell Finish, except Bathrooms and Kitchen Semi-Gloss all walls and ceiling

- 1. Premium Low Odor/VOC Latex System:

- a. Prime Coat: Primer sealer, latex, interior, Dunn-Edwards, Vinylastic Select [VNSL00](#).
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell, Dunn-Edwards, Spartawall [SWLL30](#), (Gloss Level 3).
 - Or
 - d. Topcoat: Latex, interior, semi-gloss, Dunn-Edwards, Spartawall [SWLL50](#), (Gloss Level 5).
2. Pre-Catalyzed Waterbased Epoxy: Bathrooms and Kitchen all walls and ceilings.
- a. Prime Coat: Primer sealer, latex, interior, Dunn-Edwards, Vinylastic Premium VNPR00.
 - b. Intermediate Coat: Pre-catalyzed waterbased epoxy matching topcoat.
 - c. Topcoat: Waterbased epoxy, interior, semi-gloss, Dunn-Edwards, Enduracat [ENPX50](#), (Gloss Level 5).

F. Plaster Substrates:

1. Premium Low Odor/VOC Latex System:
- a. Prime Coat: Primer, alkali resistant, water based, Dunn-Edwards, Eff-Stop Select [ESSL00](#).
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell, Dunn-Edwards, Spartawall [SWLL30](#) (Gloss Level 3).
 - Or
 - d. Topcoat: Latex, interior, semi-gloss, Dunn-Edwards, Spartawall [SWLL50](#) (Gloss Level 5).

END OF SECTION 09 91 23

**SECTION 10 21 00
TOILET COMPARTMENT DOORS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Solid plastic toilet compartments including the following:

1. Toilet Compartment Doors & Pilasters

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications.
B. Section 06 10 00 - Rough Carpentry.

1.3 REFERENCES

- A. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
C. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
E. United States EPA (Environmental Protection Agency) Registration - Bactericidal Surfaces Registered with the U.S. EPA to Legally Make Claims that these Materials Kill Infectious Bacteria.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
C. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.
D. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns.
E. Sustainable Design Submittals:
1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
2. Regional Materials: Certify distance between manufacturer and Project.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A company regularly engaged in manufacture of products

specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

- B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.
- C. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Cover all plastic components with a protective plastic masking.
- D. Performance Requirements:
 - 1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E 84:
 - a. Class A flame spread/smoke developed rating.
 - b. Class B flame spread/smoke developed rating.
 - 2. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA) 286: Pass.
 - b. International Code Council (ICC): Class B.
 - 3. Antimicrobial Touch Surfaces: Hardware touch surfaces shall be manufactured from substrates that are registered with the U.S. EPA to kill specific bacteria tested according to U.S. EPA protocols.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

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

1.8 WARRANTY

- A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. Labor not included in warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Scranton Products, which is located at: 801 E. Corey St.; Scranton, PA 18505; ASD Toll Free Tel: 800-445-5148; Fax: 855-376-6161; Email: [request info \(info@scrantonproducts.com\)](mailto:request info (info@scrantonproducts.com)); Web: <https://www.scrantonproducts.com>
 - 1. Fabricator: Santana Toilet Partitions.
 - 2. Fabricator: Comtec Toilet Partitions.
 - 3. Fabricator: Capitol Toilet Partitions
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIAL

- A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface

1. Recycled Content; Post Industrial: 100 percent.
- B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.
- C. Stainless Steel Castings: ASTM A167, Type 304.
- D. Aluminum: ASTM 6463-T5 alloy.

2.3 SOLID PLASTIC TOILET COMPARTMENT PILASTERS & DOORS

- A. Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.
 1. Style: Floor-Mounted toilet compartment pilasters & doors for installation in CMU partition.
- B. Doors and Pilasters: 1 inch (25 mm) thick with all edges rounded to a radius. Mount doors and dividing panels based on height of specified system.
 1. Door and Panel Height: 66 inches (1676 mm).
 2. Panel Edge: Standard.
 3. Pilasters: 82 inches (2083 mm) high and fastened to floor.
- C. Door/Pilaster Color: Warm series.
 1. Mocha - Orange Peel. (Verify with City staff).
- D. Pilaster Shoes: 3 inches (76 mm), 20 gauge stainless steel. Secured to pilasters with a stainless steel tamper resistant Torx head sex bolt.
- E. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design. Finish to be clear anodized. Fastened to headrail brackets with stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.
 1. Headrail Brackets: 20 gauge stainless steel with satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.
- F. Wall Brackets:
 1. Stainless Steel Brackets: Stainless steel type 304.
 2. Brackets are fastened to pilasters with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.
 3. Bracket Type: Continuous 54 inches (1372 mm) stainless steel.
- G. Door Hardware:
 1. Continuous Stainless Steel Spring Loaded Hinge:
 - a. Hinges: 54 inches (1372 mm).
 2. Door Strike/Keeper: Heavy-duty extruded aluminum 6436-T5 alloy with a bright dip anodized finish. Secured to pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper shall be made of extruded black vinyl.
 - a. Style: 6 inches (152 mm) aluminum.
 3. Latch Mechanism: Stainless Steel Slide Bolt Latch and Housing: Heavy-duty stainless steel type 304. The latch and housing to have a bright finish. The slide bolt and button to have a black anodized finish.
 4. Doors supplied with one coat hook/bumper and door pull made of chrome plated Zamak.
 5. Equip outswing handicapped doors with second door pull and door stop.

PART 3 - EXECUTION**3.1 EXAMINATION**

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

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings.
- C. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8 inch (9.5 mm).
- D. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.
- E. Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.4 PROTECTION

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

END OF SECTION 10 21 00

**SECTION 10 28 00
TOILET, BATH, & LAUNDRY ACCESSORIES**

PART 1 - GENERAL**1.1 SCOPE:**

- A. Provide toilet accessories as shown on drawings and herein specified. Locate units as shown on drawings.

1.2 SUBMITTALS:

- A. Six (6) copies of manufacturer's data and installation instructions.
- B. Provide samples of units when requested by Architect. Acceptable samples will be returned and may be used in the work.

PART 2 - PRODUCTS**2.1 MANUFACTURER:**

- A. Provide approved toilet accessories as manufactured by the following:
- B. Bobrick Washroom Equip., Inc., Aslin Industries, and Fastaire Hand Dryers Inc (as noted in the restroom accessory schedule on the plans) as a standard of quality and design. Others may be submitted for approval by the City staff based on these standards.

2.2 MATERIALS:

- A. Provide units fabricated of materials and finishes as follows:
 - 1. Stainless Steel: AISI Type 302/304, with No. 4 polished finish, unless otherwise indicated.

2.3 STEEL MOUNTING DEVICES:

- A. Hot-dip galvanized after fabrication, ASTM A386.

2.4 TOILET TISSUE DISPENSER:

- A. Provide one toilet tissue dispenser for each toilet unit, model number & location as indicated on drawings.

2.5 STAINLESS STEEL GRAB BARS:

- A. Provide stainless steel grab bars where indicated on the drawings. The grab bars shall be 48" long (minimum) when mounted at the side of the water closet and 36" long (minimum) when mounted on the wall behind the water closet (model number & location as indicated on drawings).
- B. Mounting. Concealed, with manufacturer's standard flanges welded to grab bar and anchorages for type of installation.
- C. Non-Slip Gripping Surface. Peened, manufacturer's standard, where used in wet areas.
 - 1. Size. 1 1/2" O.D., wall thickness 0.049" (minimum).
 - 2. Offset. 1 1/2".

2.6 SOAP DISPENSERS:

- A. Provide the model number, size and location indicated on drawings.

2.7 WALL MIRROR UNITS:

- A. Provide the model number, size and location indicated on drawings.

2.8 HAND DRYER:

- A. Provide at each restroom, model number & location as indicated on drawings.

2.9 TOILET SEAT COVER DISPENSER:

- A. Provide the model number, size and location indicated on drawings.

2.10 MOP & BROOM HOLDER:

- A. Bobrick B-223x36" or equal product
- B. Mount on wall adjacent to mop sink per manufacturers recommendations.

2.11 BABY CHANGING STATION

- A. Provide the model number, size and location indicated on drawings.

2.12 SANITARY NAPKIN RECEPTACLE

- A. Provide the model number, size and location indicated on drawings.

2.13 OTHER ACCESSORIES:

- A. Refer to the Restroom Accessories Schedule on the drawings. Install per manufacturer's recommendations.

PART 3 - INSTALLATION

- 3.1 Use concealed fastenings wherever possible.
- 3.2 Provide anchors, bolts and other necessary fasteners, and attach units securely to walls and partitions in locations as shown or directed. Comply with manufacturer's instructions for each type of substrate construction.
- 3.3 Install concealed mounting devices and fasteners fabricated of the same material as the accessories or of galvanized steel.
- 3.4 Install exposed mounting devices and fasteners finish to match the accessories.
- 3.5 Provide theft-resistant fasteners for all accessory mountings.

END OF SECTION 10 28 00

**SECTION 10 40 00
IDENTIFYING DEVICES****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Supply and install Accessible Signage.
- B. Supply and installed Raised Aluminum Building Signage

1.2 RELATED SECTIONS

- A. Masonry: Section 04 20 00

1.3 SUBMITTALS

- A. Per Division 1 of the project specifications, submit information for each sign type including correct symbols and Braille

1.5 PRODUCT HANDLING

- A. Use all means necessary to protect signs before, during and after installation. In event of damage, immediately make necessary repairs and replacements.

PART 2 - PRODUCTS**2.1 EXTERIOR ACCESS SIGNAGE**

- A. Refer to architectural details and State of California Title 24 signage requirements. All Signs shall be fabricated of aluminum as manufactured by Master Building Specialties, Inc., Chino, California, (800) 908-8372, or approved equal.

2.2 EXTERIOR RESTROOM SIGNAGE

- A. Provide acrylic signage for door-mounted signs per signage details on plans and complying with California Title 24 accessibility requirements including raised text, symbols, and corresponding Braille. Signage colors shall be white on blue. Signage shall be glue-applied or attached with finish screws. Double-sided tape is not acceptable.
- B. Provide custom precast concrete recessed wall signage by Quik-Crete [(909)737-6240] and complying with California Title 24 accessibility requirements including raised text, symbols, and corresponding Braille. Signage colors shall be white on blue.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Exterior recessed precast concrete restroom signs: Install per details on the plans.
- B. Exterior Door Mounted Restroom & Wall Mounted Access Signage: Shall be securely anchored to walls using tamper-proof mounting hardware.

END OF SECTION 10 40 00

**SECTION 10 52 00
FIRE PROTECTION SPECIALTIES**

PART I- GENERAL

1.01 SCOPE:

- A. This section covers everything necessary for or incidental to executing and completing the installation of miscellaneous building specialties, except as hereinafter specifically excluded.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Washroom accessories: Section 10 28 00

1.03 SUBMITTALS:

- A. Shop drawings (six sets). Details of fabrication and installation, showing materials and finishes. Color, type, size and style of lettering, as applicable.
- B. Product data (six sets). Manufacturer's descriptive data, installation instructions, and procedures for care of finished surfaces.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver items in manufacturer's original, unopened protective packaging. Store in original packaging, off the ground and under protective covers. Handle so as to prevent damage.

PART II- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Regularly engaged in production of items in each category which meet project requirements.

2.02 FIRE CABINET AND EXTINGUISHERS:

- A. Fire extinguisher cabinets shall be J.C. Industries Cosmopolitan 1037G13 recessed cabinet with SAF-T-Lok or approved equal. Extinguisher: Multi-purpose type, UL rating 4A-40B:c, Standard ABC-10.

PART III- EXECUTION

3.01 INSPECTION:

- A. Check that surfaces to receive mounting are completed.
- B. Provide mounting templates and instruction to other trades whose work encompasses the accessory involved.
- C. Provide mounting accessories to the masonry trade for incorporation into their work.

3.02 INSTALLATION:

- A. Installation of all building specialty items shall be according to the manufacturer's printed instructions.

3.03 CLEANING:

- A. Touch up scratched, marred or abraded surfaces to match original.
- B. Wipe finished surfaces and leave adjacent surfaces clean.

END OF SECTION 10 52 00

**SECTION 10 82 00
LOUVERS, GRILLES & SCREENS**

PART 1 - GENERAL

1.1 SCOPE:

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified, and as necessary to complete the contract, including but not limited to these major items:

1. Walls Louvers, factory fabricated and finished.

1.2 RELATED WORK ELSEWHERE:

- A. Sheet Metal, Section 07 60 00.

1.3 GENERAL REQUIREMENTS:

- A. Field Conditions. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report to the Architect all conditions which prevent proper execution of this work.

1.4 SUBMITTALS:

- A. Manufacturer's Data.

1. Submit six (6) copies of manufacturer's specifications, roughing-in diagrams, and installation instructions for each type and size of shutters. Include manufacturer's data, operating instructions and maintenance data. Indicate by transmittal form that installer has received a copy of diagrams and installation instructions.

- B. Shop Drawings.

1. Submit six sets of shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets.

1.5. INSERTS AND ANCHORAGES:

- A. Furnish inserts and anchoring devices which must be set in masonry wall for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

1.6 MANUFACTURER:

- A. Provide louvers and vents as manufactured by the Airlite Company or approved equal.

1.7 DELIVERY AND STORAGE:

- A. Deliver materials and store on site in original containers in accordance with Division 1 of the specifications.

PART 2 - MATERIALS

2.1 LOUVERS:

- A. Louvers shall be architectural blade Louver Type K604 with visible vertical mullions (where shown on drawings) Louvers shall be 4.5-inches (114 mm) deep and assembled entirely from extruded aluminum components. Blades and frames shall be 0.081-inch (2 mm) thick extruded aluminum, alloy 6063-T5. Blades shall be stationary, horizontal and spaced 4.5-inches (112 mm) on center.
 - B. Welded Assembly: Join stationary blade, head and jamb frames with fillet welds concealed from view. Louver blades shall be joined to each jamb frame with a minimum of two 0.5-inch (13 mm) long fillet welds produced. Frames shall be joined at each corner with a minimum of two 0.5-inch (13mm) long fillet welds.
 - C. Louvers shall be furnished with bird screen, insect screen, supports, installation hardware and finishes as specified and as required for a complete installation.
 - D. Provide louvers and bird/bug screen assembly, sizes per plans.
 - E. All louvers shall be factory finished after assembly with an alkyd baked enamel finish color as indicated on plans. Submit color samples for review.
- 2.2 FASTENERS:
- A. As specified by the manufacturer for installation in a CMU wall opening (minimum stainless steel machine bolts and screws, 1/4" diameter and length as required).
- 2.3 SEALANT:
- A. As specified in Section 07 92 00.

PART 3 - EXECUTION

- 3.1 INSPECTION:
- A. Inspect openings and adjacent surfaces. Report, in writing, to the Architect all conditions which prevent proper execution of this work.
- 3.2 INSTALLATION:
- A. Install in openings prepared by other trades. Secure in manner recommended by louver manufacturer.
 - B. Clean Up and Repair:

Replace any damaged work and materials. Perform final cleaning of all surfaces, strictly in accordance with manufacturer's instructions. Use no abrasives.

END OF SECTION 10 82 00

SECTION 14 24 00
Hydraulic Elevators

PART 1 - GENERAL**1.01** Summary

- A. This section specifies hydraulic elevators.
- B. Work Required
 - 1- The work required under this section consists of all labor, materials and services required for the complete installation (including operational verification) of all the equipment required for the elevator(s) as herein specified.
 - 2- Obtaining all required state, local, and any other required permits.
 - 3- All work shall be performed in a first class, safe and workmanlike manner.
 - 4- In all cases where a device or part of the equipment is herein referred to in the singular, it is intended that such reference shall apply to as many of such devices or parts as are required to make complete installation.

1.02 Related Sections

- A. The following sections contain requirements that relate to this section and are performed by trades other than the elevator manufacturer/installer.
 - 1- Section 01 50 00 – Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting.
 - 2- Section 03 30 00 – Cast-In-Place Concrete: elevator pit, elevator motor and pump foundation, and grouting thresholds.
 - 3- Section 04 20 00 – Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills.
 - 4- Section 05 50 00 – Metal Fabrications: pit ladder, divider beams, supports for entrances and rails, and hoisting beam at top of elevator hoistway.
 - 5- Cementitious Waterproofing (see sections on plans): waterproofing of elevator pit.
 - 6- Division 23 – Heat Generation Equipment: ventilation and temperature control of elevator equipment areas.
 - 7- Section 26 05 00 – Common Work Results for Electrical:
 - a. Main disconnects for each elevator.
 - b. Electrical power for elevator installation and testing.
 - c. Disconnecting device to elevator equipment prior to activation of sprinkler system.
 - d. The installation of dedicated GFCI receptacles in the pit and overhead.
 - e. Lighting in controller area, machine area and pit.
 - f. Wiring for telephone service to controller.
 - 8- Division 26 – Emergency (Standby) Power Supply Systems (if required by governing codes): emergency generator for elevator operation.
 - 9- Division 27– Voice Communications: ADAAG-required emergency communications equipment.

- 10- Fire Alarm Systems (deferred submittal by installing contractor): fire and smoke detectors at required locations and interconnecting devices; fire alarm signal lines to contacts in the machine area.
- 11- Division 31 – Site Clearing: excavation for cylinder well casing.

1.03 References

- A. Comply with applicable building and elevator codes at the project site, including but not limited to the following:
 - 1- ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
 - 2- ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.
 - 3- ADAAG, American Disabilities Act Accessibility Guidelines.
 - 4- ANSI A117.1, Building and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
 - 5- ANSI/NFPA 70, (NEC) National Electrical Code.
 - 6- CAN/CSA C22.1, (CEC) Canadian Electrical Code.
 - 7- ANSI/UL 10B, Standard for Fire Test of Door Assemblies.
 - 8- CAN/ULC-S104-10, Standard Method for Fire Test of Door Assemblies.
 - 9- ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives.
 - 10- Building Code, CBC, IBC, or NBCC.
 - 11- All Local Jurisdictional applicable codes.

1.04 System Description

- A- Equipment Description: Hole-less Hydraulic elevator with machine-room less application
- B- Equipment Control: Elevonic® Control System.
- C. Quantity of Elevators: 1
- D. Elevator Stop Designations: 1, 2
- E. Stops: 2
- F. Openings: Front Only
- G. Travel: 12'-0"
- H. Rated Capacity: 3500
- I. Rated Speed: 100 fpm
- J. Platform Size: 6'-6 3/4" W x 6'-8 3/16" D
- K. Clear Inside Dimensions: 6' 5 9/16" x 5' 5 9/16"
- L. Cab Height: 93"
- M. Clear Cab Height: 7'-4 5/16" (2243 mm)
- N. Entrance Type and Width: Single Slide - 3'6"
- O. Entrance Height: 84"
- P. Main Power Supply: 480 volts □ 5% of normal, three-phase, with a separate equipment grounding conductor.
- Q. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.
- R. Machine Location: No machine-room required, tank and controller in hoistway pit.

- S. Signal Fixtures: Manufacturer's standard with metal button targets (excluding CA).
- T. Controller Location: In a machine space or closet
- U. Operation :**Simplex Collective Operation:** Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
- V. Operation Features – Standard
 - 1- Full Collective Operation
 - 2- Anti-nuisance.
 - 3- Fan and Light Protection.
 - 4- Load Weighing Bypass.
 - 5- Independent Service.
 - 6- Firefighters' Service Phase I and Phase II (USA only); or Special Emergency Service Phase I and II – Emergency Recall and In-Car Emergency Operation (Canada only).
 - 7- Top of Car Inspection.
- W. Operation Features – Optional
 - 1- Zoned Access at Bottom Landing.
 - 2- Zoned Access at Upper Landing.
 - 3- Express Priority Service with key-switch(es)
 - 4- Emergency Hospital Service.
 - 5- Automatic Rescue Operation
 - 6- Automatic Standby Power Operation with Manual Override.
- X. Door Control Features:
 - 1- Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
 - 2- Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
 - 3- Door protection shall consist of a two-dimensional, multi-beam array projecting across the car door opening.
 - 4- Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.
- Y. Provide equipment for seismic conditions: Yes

1.05 Submittals

- A. Product Data: Submit manufacturer's product data for each system proposed for use. Include the following:
 - 1- Signal and operating fixtures, operating panels and indicators.
 - 2- Cab design, dimensions and layout.
 - 3- Hoistway-door and frame details.
 - 4- Electrical characteristics and connection requirements.
 - 5- Expected heat dissipation of elevator equipment in hoistway (BTU).

- 6- Color selection chart for Cab and Entrances.
- B. Shop Drawings: Submit approval layout drawings. Include the following:
 - 1- Car, guide rails, buffers, and other components in hoistway.
 - 2- Maximum rail bracket spacing.
 - 3- Maximum loads imposed on guide rails requiring load transfer to building structure.
 - 4- Clearances and travel of car.
 - 5- Clear inside hoistway and pit dimensions.
 - 6- Location and sizes of access doors, hoistway entrances and frames.
- C. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.

1.06 Quality Assurance

- A. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.
- B. Manufacturer shall have a minimum of fifteen years of experience in the fabrication, installation and service of elevators.
- C. Installer: Elevators shall be installed by the manufacturer.
- D. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

1.07 Delivery, Storage, and Handling

- A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.
- B. Should the storage area be off-site, and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage, and redeliver to the job site shall not be at the expense of the elevator contractor.

1.08 Warranty

- A. The elevator contractor's acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall not extend longer than one (1) year from the date of completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

1.09 Maintenance and Service

- A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of 12 Months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be

performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs, or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

- B. The elevator control system must:
 - 1- Provide in the controller the necessary devices to run the elevator on inspection operation.
 - 2- Provide on top of the car the necessary devices to run the elevator in inspection operation.

PART 2 - PRODUCTS

2.01 Manufacturer

- A. Manufacturer: Design based upon Otis HydroFit™ machine room-less elevator system.

2.02 Design and Specifications

- A- Provide hydraulic elevators from Otis Elevator Company. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
 - 1- The entire hydraulic system and the controller shall be located inside the hoistway. No extra machine room or control closet space is required.
 - 2- LED lighting standard in ceiling lights and elevator fixtures.
 - 3- Sleep mode operation for LED ceiling lights and car fan.
- B. Approved Installer: Otis Elevator Company

2.03 Equipment: Machine Components

- A. The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a low-pressure switch and a shut-off valve.
- B. The entire hydraulic system with hydraulic-fluid storage tank, power component and valves shall be located in the hoistway pit and be easily accessible for maintenance through an access door in the hoistway wall.
- C. A microprocessor-based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.
- D. The controller shall be located together with the hydraulic system in the hoistway pit and be easily accessible for maintenance through the same access door that is also used for the hydraulic system. The controller will be located in the optional remote machine room if selected.
- E. A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.
- F. Pressure Switch

- G. Tank Heater- Optional
- H. Low-oil control (where required)

2.04 Equipment: Hoistway Components

- A. Plunger(s) and Cylinder(s): Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.
- B. Car Guide Rails: Tee-section steel rails with brackets and fasteners.
- C. Polyurethane type buffers shall be used.
- D. Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car.
- E. Hoistway Entrances:
 - 1- Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
 - 2- Sills shall be extruded: Aluminum
 - 3- Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
 - 4- Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour
 - 5- Entrance Finish: Satin Stainless Steel
 - 6- Entrance Marking Plates: Entrance jambs shall be marked with 4" x 4" (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
 - 7- Sight Guards: Sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel doors.

2.05 Equipment: Car Components

- A. Cab: Steel Shell Cab with raised laminate wall panels
Brushed Stainless Steel finished vertical trim pieces are optional.
- B. Car Front Finish: Brushed Stainless Steel.
- C. Car Door Finish: Brushed Stainless Steel.
- D. Ceiling Type: Dropped ceiling with LED lights
- E. Car Front Finish: Brushed Stainless Steel.
- F. Car Door Finish: Brushed Stainless Steel.
- G. Ceiling Finish: Brushed Steel Finish
- H. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

- I. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.
- J. Handrails: Brushed steel finish, 3/8" x 2" flat tubular bar handrails shall be provided on the side and rear walls
- K. Threshold: Aluminum
- L. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
- M. The LED ceiling lights, and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.
- N. Certificate frame: Provide a Certificate frame with a Brushed Stainless Steel finish.

2.06 Equipment: Signal Devices and Fixtures

- A. The car operating panel shall be equipped with the following features:
 - a. Raised markings and Braille to the left-hand side of each push-button.
 - b. Car Position Indicator at the top of and integral to the car operating panel.
 - c. Door open and door close buttons.
 - d. Inspection key-switch.
 - e. Elevator Data Plate marked with elevator capacity and car number.
 - f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
 - g. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
 - h. In car stop switch (toggle or key unless local code prohibits use)
 - i. Firefighter's hat (standard USA)
 - j. Firefighter's Phase II Key-switch (standard USA)
 - k. Call Cancel Button (standard USA)
 - l. Firefighter's Phase II Emergency In-Car Operating Instructions: worded according to A17.1 2000, Article 2.27.7.2.
- B. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.
- C. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation.
 - 1- Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance frame face. Buttons shall be in vertically mounted fixture. Fixture shall be Brushed Stainless Steel finish.
 - 2- Button: Flat flush mounted, Brushed Stainless Steel button with blue or white LED illuminating halo

- 3- Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound.
- D. Access key-switch at top floor in entrance jamb.
- E. Access key-switch at lowest floor in entrance jamb.
- F. Card Reader Provision is Optional

PART 3 - EXECUTION**3.01** Preparation

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.
- B. The contractor shall be responsible for obtaining all required state & other permits, and shall provide all materials required for all permit submittal, and shall be responsible for making all required submittals for approval & permitting.

3.02 Installation

- A. Installation of all elevator components except as specifically provided for elsewhere by others.

3.03 Demonstration

- A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.

END OF SECTION 14 24 00

SECTION 21 05 17
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metraflex Company (The).
 - 2. Pipeline Seal and Insulator, Inc.
 - 3. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
- C. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6 : Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

END OF SECTION 21 05 17

SECTION 21 05 53**IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS**2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: Red.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 6. Fasteners: Stainless-steel rivets.
 - 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

- C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.
- E. Pipe-Label Colors:
 - 1. Background Color: Red.
 - 2. Letter Color: White.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain.
 - 3. Valve-Tag Color: Red.
 - 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 1. Valve-Tag Size and Shape:
 - a. Fire-Suppression Standpipe: 1-1/2 inches, round.
 - b. Wet-Pipe Sprinkler System: 1-1/2 inches, round.

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53

SECTION 21 13 13**WET-PIPE SPRINKLER SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Sprinklers.
 - 4. Alarm devices.
 - 5. Pressure gages.
- B. Related Sections:
 - 1. Section 211200 "Fire-Suppression Standpipes" for standpipe piping.

1.3 DEFINITIONS

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.
- B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

- A. The Contractor shall be responsible for the Automatic Fire Sprinkler inside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite Fire system. This specification is intended to establish the required performance and quality of the work necessary to provide for a complete automatic sprinkler system above and below ceiling to serve the buildings on site as indicated on the drawings.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - e. Office and Public Areas: Light Hazard.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - 4. Maximum Protection Area per Sprinkler: Per UL listing.
 - 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.

- b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- C. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- E. Fire-hydrant flow test report.
- F. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, thinwall, with plain ends and wall thickness less than Schedule 10.
- D. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- E. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
- F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Malleable- or Ductile-Iron Unions: UL 860.
- H. Cast-Iron Flanges: ASME 16.1, Class 125.
- I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- K. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- L. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
 - 3. Minimum Pressure Rating for High-Pressure Piping: 250 psig.
- B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Victaulic Company.
2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.
- C. Check Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. NIBCO INC.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 2. Standard: UL 312.
 3. Pressure Rating: 250 psig minimum.
 4. Type: Swing check.
 5. Body Material: Cast iron.
 6. End Connections: Flanged or grooved.
- D. Indicating-Type Butterfly Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 2. Standard: UL 1091.
 3. Pressure Rating: 175 psig minimum.
 4. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
 5. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
 6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch visual indicating device.

2.5 TRIM AND DRAIN VALVES

- A. General Requirements:
 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Pressure Rating: 175 psig minimum.
- B. Angle Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire Protection Products, Inc.
 - b. United Brass Works, Inc.
- C. Ball Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.

- D. Globe Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire Protection Products, Inc.
 - b. United Brass Works, Inc.
- E. Plug Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

- A. General Requirements:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
 - b. High-Pressure Piping Specialty Valves: 250 psig minimum.
 - 3. Body Material: Cast or ductile iron.
 - 4. Size: Same as connected piping.
 - 5. End Connections: Flanged or grooved.
- B. Alarm Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL 193.
 - 3. Design: For horizontal or vertical installation.
 - 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages and fill-line attachment with strainer.

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Flow Detection and Test Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.
- B. Sprinkler Inspector's Test Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.
 - c. Viking Corporation.
 - 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with sight glass.
 - 5. Size: Same as connected piping.

6. Inlet and Outlet: Threaded.

2.8 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Reliable Automatic Sprinkler Co., Inc.
 2. Tyco Fire & Building Products LP.
 3. Victaulic Company.
- B. General Requirements:
 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 1. Early-Suppression, Fast-Response Applications: UL 1767.
 2. Nonresidential Applications: UL 199.
 3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
 1. Color and finish of all corrosion-resistant sprinklers shall be as approved by Architect.
- E. Water-Flow Indicators:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Potter Electric Signal Company.
 2. Standard: UL 346.
 3. Water-Flow Detector: Electrically supervised.
 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 5. Type: Paddle operated.
 6. Pressure Rating: 250 psig.
 7. Design Installation: Horizontal or vertical.
- F. Valve Supervisory Switches:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Potter Electric Signal Company.
 2. Standard: UL 346.
 3. Type: Electrically supervised.
 4. Components: Single-pole, double-throw switch with normally closed contacts.
 5. Design: Signals that controlled valve is in other than fully open position.

2.9 Sprinkler Heads:

- A. Interior Finished Ceilings and Exterior Soffits:
 1. Heads shall be Reliable Model F1FR quick response sprinkler, recessed standard spray pendent with bright chrome finish. Pendent heads shall be Reliable Model F1FR quick response sprinkler, standard spray pendent with bright chrome finish. Escutcheons shall be Model F2. Equivalent products of Viking or Tyco are acceptable. Corrosion-resistant finish shall be installed at exterior areas; finish shall be polyester or Teflon coating with matching escutcheon. Color and finish of all corrosion-resistant sprinklers shall be as approved by Architect.
 2. All areas without Suspended Ceilings, Concealed Areas, Unfinished Ceilings and Storage Areas: Heads shall be Reliable, model F1FR quick response sprinkler upright/pendent with rough brass finish. Equivalent products of Viking or Tyco are acceptable. Where required, escutcheons shall be Sweet and Donaldson #401 with chrome finish at storage, mechanical, and electrical room ceilings.

3. Concealed Areas: Heads shall be Reliable, model F1FR quick response sprinkler upright/pendent with rough brass finish. Equivalent products of Viking or Tyco are acceptable. Where required, escutcheons shall be Sweet and Donaldson #401 with chrome finish at storage, mechanical, and electrical room ceilings.
 4. Sidewall Sprinklers: Sidewall sprinklers Reliable Model F1FR quick response sprinkler, and may be installed for interior and exterior applications, subject to prior approval by Architect. Heads shall be Reliable Model F1FR quick response sprinkler horizontal, with bright chrome finish. Equivalent products of Viking or Tyco are acceptable.
 5. Temperature Ratings: Heads below finished ceilings, and in all other occupied areas shall have a temperature rating of Ordinary (155-165 degrees). Heads in unventilated, concealed and void spaces shall have a temperature rating of Intermediate (200-212 degrees), unless otherwise required by code.
 6. Provide metal cabinet for a reserve supply of sprinkler heads, as required by N.F.P.A. 13. Include suitable head wrenches for each type of sprinkler installed. Stock shall include all types and temperature ratings installed. Locate as directed by Architect.
- B. Special Coatings:
1. Wax.
 2. Lead.
 3. Corrosion-resistant paint.
- C. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- D. Water-Flow Indicators:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Potter Electric Signal Company.
 2. Standard: UL 346.
 3. Water-Flow Detector: Electrically supervised.
 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 5. Type: Paddle operated.
 6. Pressure Rating: 250 psig.
 7. Design Installation: Horizontal or vertical.
- E. Valve Supervisory Switches:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Potter Electric Signal Company.
 2. Standard: UL 346.
 3. Type: Electrically supervised.
 4. Components: Single-pole, double-throw switch with normally closed contacts.
 5. Design: Signals that controlled valve is in other than fully open position.

2.10 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK; U.S. Gauge Division.
 2. Ashcroft, Inc.
 3. Brecco Corporation.
 4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

- D. Pressure Gage Range: 0 to 250 psig minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."

3.3 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."
- B. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 1 and smaller, shall be the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 1-1/4 to NPS 4, shall be one of the following:
 - 1. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - 3. Thinwall Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- E. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
 - 1. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - 3. Thinwall Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

4. Thinwall Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 1. Fire Station: Quick response concealed sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 1. Concealed Sprinklers: Color and finish of all corrosion-resistant sprinklers shall be as approved by Architect.

END OF SECTION 21 13 13

SECTION 22 05 13**COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

1.4 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.5 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body having jurisdiction thereof.

- B. 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 Owner's representative.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:

- a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
- c. Include all pertinent construction, installation, performance and technical data.
- d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this

and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40°C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 05 13

SECTION 22 05 18**ESCUTCHEONS FOR PLUMBING PIPING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.13 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

SECTION 22 05 19**METERS AND GAGES FOR PLUMBING PIPING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Bimetallic-actuated thermometers.
 2. Filled-system thermometers.
 3. Thermowells.
 4. Dial-type pressure gages.
 5. Gage attachments.
 6. Test plugs.
 7. Test-plug kits.
 8. Sight flow indicators.

1.3 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
1. C.C.R., Title 24, Part 5 (2022 CPC).
 2. 2022 California Plumbing Code.
 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California State Division of Industrial Safety.
 6. County Health Department.
 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.4 SUBMITTAL DATA

- A. Submittal Requirements:
1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of

the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ashcroft Inc.
 2. Ernst Flow Industries.
 3. Marsh Bellofram.
 4. Miljoco Corporation.
 5. Nanmac Corporation.
 6. Palmer Wahl Instrumentation Group.
 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.

- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Marsh Bellofram.
 - c. Miljoco Corporation.
 - d. Palmer Wahl Instrumentation Group.
 - e. REOTEMP Instrument Corporation.
 - f. Terice, H. O. Co.
 - g. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.

2.3 LIGHT-ACTIVATED THERMOMETERS

A. Direct-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flo Fab Inc.
 - b. REOTEMP Instrument Corporation.
 - c. Terice, H. O. Co.
 - d. Weiss Instruments, Inc.
 - e. WIKA Instrument Corporation - USA.
 - f. Winters Instruments - U.S.
2. Case: Metal; 7-inch or 9-inch nominal size unless otherwise indicated.
3. Scale(s): Deg F.

4. Case Form: Adjustable angle.
5. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
6. Stem: Aluminum and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

7. Display: Digital.
8. Accuracy: Plus or minus 2 deg F.

B. Remote-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Miljoco Corporation.
- b. Weiss Instruments, Inc.
- c. Winters Instruments - U.S.

2. Case: Plastic, for wall mounting.
3. Scale(s): Deg F.
4. Sensor: Bulb and thermister wire.

a. Design for Thermowell Installation: Bare stem.

5. Display: Digital.
6. Accuracy: Plus or minus 2 deg F.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AMETEK, Inc.; U.S. Gauge.
- b. Ashcroft Inc.
- c. Ernst Flow Industries.
- d. Flo Fab Inc.
- e. Marsh Bellofram.
- f. Miljoco Corporation.
- g. Noshok.
- h. Palmer Wahl Instrumentation Group.
- i. REOTEMP Instrument Corporation.
- j. Tel-Tru Manufacturing Company.
- k. Trerice, H. O. Co.
- l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
- m. Weiss Instruments, Inc.
- n. WIKA Instrument Corporation - USA.
- o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. Flo Fab Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Trerice, H. O. Co.
 - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - m. Weiss Instruments, Inc.
 - n. WIKA Instrument Corporation - USA.
 - o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

C. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Miljoco Corporation.
 - d. Noshok.
 - e. Palmer Wahl Instrumentation Group.
 - f. REOTEMP Instrument Corporation.

- g. Tel-Tru Manufacturing Company.
- h. Trerice, H. O. Co.
- i. Weiss Instruments, Inc.
- j. WIKA Instrument Corporation - USA.
- k. Winters Instruments - U.S.

- 2. Standard: ASME B40.100.
- 3. Case: Sealed 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
- 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- 5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- 6. Movement: Mechanical, with link to pressure element and connection to pointer.
- 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
- 8. Pointer: Dark-colored metal.
- 9. Window: Glass.
- 10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flow Design, Inc.
 - 2. Miljoco Corporation.
 - 3. National Meter, Inc.
 - 4. Peterson Equipment Co., Inc.
 - 5. Sisco Manufacturing Company, Inc.
 - 6. Trerice, H. O. Co.
 - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 8. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flow Design, Inc.
 - 2. Miljoco Corporation.
 - 3. National Meter, Inc.
 - 4. Peterson Equipment Co., Inc.
 - 5. Sisco Manufacturing Company, Inc.
 - 6. Trerice, H. O. Co.
 - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 8. Weiss Instruments, Inc.
- B. Furnish one test-plug kit containing one thermometer, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1 to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F .
- D. High-Range Thermometer: Small, bimetallic insertion type with 1 to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2 to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200.
- F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- B. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- C. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- D. Install remote-mounted pressure gages on panel.
- E. Install valve and snubber in piping for each pressure gage for fluids.
- F. Install test plugs in piping tees.
- G. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Outlet of mixing valves with access panel.

H. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

3.2 CONNECTIONS

A. Install meters adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Water Piping: 0 to 100 psi.
- B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 220519

SECTION 22 05 23**GENERAL-DUTY VALVES FOR PLUMBING PIPING****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. Section Includes:
 - 1. Bronze ball valves.
 - 2. Ductile-iron, single-flange butterfly valves.
 - 3. Bronze lift check valves.
 - 4. Bronze swing check valves.
 - 5. Bronze gate valves.
 - 6. Iron gate valves
 - 7. Manual circuit balancing valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.5 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
1. C.C.R., Title 24, Part 5 (2022 CPC).
 2. 2022 California Plumbing Code.
 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California State Division of Industrial Safety.
 6. County Health Department.
 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit

detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.12 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61-G and NSF-372 for valve materials for potable-water service.
 1. Valves for domestic water must comply with the Federal Reduction of Lead in Drinking Water Act.
 - a. "Lead Free" refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$.
 - b. All valves must be 3rd party certified.
 - c. Bronze valves shall be made of dezincification-resistant material.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.

5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.14 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.16 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Piping systems shall be supplied with valves arranged so as to give complete and regulating control of each building and piping systems throughout the building, and located so all parts are easily accessible and maintained.
 - 1. Valve Design: Rising stem or outside screw and yoke stems. Non-rising stem valves may be used where space conditions prevent full extension of rising stems.
 - 2. Sizes: Same size as upstream pipe, unless otherwise indicated.
 - 3. Extended stems: Where piping insulation is indicated or specified, valves shall be equipped with 2" extended handles of non-thermal conductive material. Also provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Supply with memory stops, which are fully adjustable after insulation is applied.
 - 4. End Connection: 2 inch and under shall be threaded, 2-1/2 inches and larger shall be flanged or full lug style.
- C. Valves for Potable Water must comply with California Lead Free Law, effective January 1, 2010.
 - 1. "Lead Free" refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$. Source: California Health & Safety Code (116875).
 - 2. All valves must be 3rd party certified.
 - 3. Bronze valves shall be made with dezincification-resistant material.
- D. Where possible, valves of one manufacturer shall be used.
- E. Provide Class 150 valves meeting the valve specifications where Class 125 valves are specified but are not available.
- F. Bronze valves shall be made with dezincification-resistant materials, (Bronze ASTM B62, B61, or B584 Alloy C87850). This includes body, ball, stem and / or trim.
- G. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- H. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- I. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- J. Valve Sizes: Same as upstream piping unless otherwise indicated.
- K. Valve Actuator Types:
 - 1. Hand-wheel: For valves other than quarter-turn types.
 - 2. Hand-lever: For quarter-turn valves NPS 6 and smaller.
- L. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Nib-seal handle extension or comparable product by one of the following:
 - b. General valves:
 - 1) NIBCO
 - 2) Hammond
 - 3) Milwaukee
 - c. Below grade domestic water shut-off valves (gate valves) 2" and larger:
 - 1) NIBCO.
 - 2) Clow.
 - 3) Mueller.
 - d. Butterfly Valves:
 - 1) NIBCO.
 - 2) Demco.
 - 3) Dezuric.
 - e. Plug Valves:
 - 1) Hammond.
 - 2) Milwaukee.
 - f. Check valves, lift type:
 - 1) Hammond.
 - 2) Milwaukee.
 - g. Below grade backwater valve isolation valves:
 - 1) NIBCO.
 - 2) Clow.
 - 3) Mueller.
 2. Butterfly Valves: With extended neck.
- M. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
 2. Grooved: With grooves according to AWWA C606.
 3. Solder Joint: With sockets according to ASME B16.18.
 4. Threaded: With threads according to ASME B1.20.1.
- N. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim & Nib-Seal Handle:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-595-Y-66-LF or T-595-Y-66-LF or a comparable product by one of the following,
 - a. Milwaukee Valve Company.
 - b. Apollo.
2. Description:
 - c. Standard: MSS SP-110, NSF 61-G.
 - d. CWP Rating: 600 psig.
 - e. Body Design: Three piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
 - f. Body Material: Bronze ASTM B 584 Alloy C87850 or C87600.
 - g. Ends: Threaded or Solder.
 - h. Seats: PTFE or TFE.
 - i. Stem: 316 Stainless steel.
 - j. Ball: 316 Stainless steel, vented.
 - k. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim & Nib-Seal Handle:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-585-66-LF or T-585-66-LF or a comparable product by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Milwaukee Valve Company.
2. Description:
 - a. Standard: MSS SP-110, NSF 61-G.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
 - d. Body Material: Bronze ASTM B 584 Alloy C87600.
 - e. Ends: Threaded or Solder.
 - f. Seats: PTFE or TFE.
 - g. Stem: 316 Stainless steel.
 - h. Ball: 316 Stainless steel, vented.
 - i. Port: Full.

C. 200 CWP, Sizes 2-1/2" – 24", Ductile Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model LD-2000-3/5, or a comparable product by one of the following:
 - a. Cooper Cameron Corp.; Cooper Cameron Valves Div.
 - b. Tyco International, Ltd.; Tyco Valves & Controls

2. Description:

- a. Standard: MSS SP-67, Type I, IAPMO.
- b. NPS 24 (DN 300) and Smaller CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Full Lug type; Bubble tight shutoff, suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze

- D. Retain one or more of six paragraphs in this article if iron, single-flange butterfly valves are required. MSS SP-67 covers iron, single-flange butterfly valves NPS 1-1/2 to NPS 72.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-480-Y-LF or T-480-Y-LF or a comparable product by one of the following:
 - a. Hammond.
 - b. Milwaukee.
- 2. Description:
 - a. Standard: MSS SP-80, Type 2, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 584 Alloy C87850, lead free bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: PTFE, or TFE.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Nonmetallic TFE Disc:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-Y-LF or T-413-Y-LF or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
- 2. Description:
 - a. Standard: MSS SP-80, Type 4, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Y-pattern Horizontal flow.
 - d. Body Material: ASTM B 584 Alloy C87850, lead free bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: PTFE or TFE.

2.5 BRONZE GATE VALVES

A. NRS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-113-LF or T-113-LF or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-139, Type 2, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 584, dezincification-resistant bronze with integral seat and threaded bonnet.
 - d. Ends: Threaded or Solder.
 - e. Stem: Lead free Silicon Bronze.
 - f. Disc: Solid wedge; lead free bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

B. RS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-111-LF or T-111-LF or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves
2. Description:
 - a. Standard: MSS SP-80, Type 2, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B584 C87850 dezincification resistant bronze with integral seat and threaded bonnet.
 - d. Ends: Threaded or Solder.
 - e. Stem: Lead free silicon bronze.
 - f. Disc: Solid wedge, lead free bronze.
 - g. Packing: Asbestos free.
 - h. Handwhell: Malleable iron.

2.6 IRON GATE VALVES

A. Class 125, Ductile-Iron Resilient Wedge Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-619-RWS (NRS) or F-607-RWS (OS&Y) or a comparable product by one of the following:
 - a. Clow
 - b. Mueller

2. Description:

- a. Standard: AWWA C-509 and C-515,
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM A-536 ductile iron, fusion-bonded epoxy coating inside and out.
- d. Ends: Flanged.
- e. Trim: stainless steel.
- f. Disc: Rubber encapsulated ductile iron wedge.
- g. Packing and Gasket: Asbestos free.

2.7 MANUAL CIRCUIT BALANCING VALVES

A. Bronze, Fixed Orifice, Balancing Valves (2" and smaller):

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T/S-1810-LF or a comparable product by one of the following:
 - a. Or approved equal
- 2. Description:
 - a. CWP Rating: 300 psig
 - b. Maximum Operating Temperature: 260°F.
 - c. Body Material: Bronze or dezincification-resistant brass, lead free, Y-pattern globe type with fixed orifice (venture) for precise regulation and control. NO QUARTER TURN VALVES WILL BE ACCEPTED.
 - d. Plug: Bronze or dezincification-resistant brass with EPDM O-Rings.
 - e. Seat: Bronze or dezincification-resistant brass.
 - f. Ends: Threaded or Solder.
 - g. Pressure Gage Connections: Shall have two metering test ports with internal check and protective caps for use with portable differential pressure metering stations.
 - h. Handle Style: Calibrated hand wheel equipped with visual position readout and hidden memory stops for repeatable regulation and control.

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves (2-1/2" and larger):

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F/G 737A or a comparable product by one of the following:
 - a. Tour & Andersson
- 2. Description:
 - a. CWP Rating: 240 psig
 - b. Maximum Operating Temperature: 250°F.
 - c. Body Material: Cast-iron or steel body, globe pattern with calibrated orifice. NO BUTTERFLY VALVES.
 - d. Stem Seals: EPDM O-Rings
 - e. Disc: EPDM coated cast-iron disc.

- f. Seat: Bronze or dezincification brass.
- g. Ends: Flanged or grooved.
- h. Pressure Gage Connection: Integral seals for portable differential pressure meter.
- i. Handle Style: Calibrated hand wheel equipped with visual position readout and concealed memory stops for repeatable regulation and control.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball or Butterfly valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: Threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 - 3. Bronze Lift Check Valves: Class 125, nonmetallic TFE disc.
 - 4. Bronze Swing Check Valves: Class 150, nonmetallic TFE disc.
 - 5. Bronze Gate Valves: Class 150, RS.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Ductile-Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

END OF SECTION 22 05 23

SECTION 22 05 29**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.6 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
1. C.C.R., Title 24, Part 5 (2022 CPC).
 2. 2022 California Plumbing Code.
 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California State Division of Industrial Safety.
 6. County Health Department.
 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.7 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of

the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.13 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.14 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.16 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any

part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Pipe Supports: Unless otherwise indicated on the drawings, shall be as follows:

- A. The Contractor shall furnish and install all miscellaneous iron work including angles, channels, etc., required to appropriately support the various piping systems. Hanger spacing and location shall conform to 2019 California Plumbing Code Table 313.1.
- B. All horizontal runs of piping within the building to be supported from the structural framing with steel rods and split ring hangers, B-Line, Grinnell Company, Tolco, or approved equal. Steel rods shall be secured to overhead framing with side beam connectors. Where necessary, install angle iron between framing to accommodate hanger rods. Where several pipes are running together, Unistrut, B-Line or Powerstrut channels with clamps may be used in lieu of individual pipe hangers, and supported from structure as herein specified. Submit test data for type of hanger supports to be provided. For support conditions other than specified herein, the Contractor shall submit method of support for approval prior to any installation.
- C. Horizontal Piping Hangers and Supports:
 - 1. General: Provide factory fabricated horizontal hangers and supports complying with one of the following MSS types listed to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - a. Adjustable Steel Clevis Hangers: (MSS Type 1.) B-Line B 3100
 - b. Adjustable Swivel Pipe Rings: (MSS Type 5) B-Line B3690
- D. Vertical-Piping Clamps:
 - 1. General: Provide factory fabricated vertical-piping clamps complying with the following types listed, to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
 - 2. Two-Bolt Riser Clamps: (MSS Type 8) B-Line B3373
- E. Hanger-Rod Attachments:

1. General: Provide factory fabricated hanger-rod attachments B-Line, Tolco or approved equal, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-58 and manufacturer's published product information. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
2. Side beam eye socket, Tolco Fig. #57 for rod sizes 3/8" dia. and Tolco Fig. #25-30-251 for rod sizes 1/2" dia.

F. Building Attachments:

1. General: Provide factory fabricated building attachments, selected by Installer to suit building structural framing conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

G. Hanger Rods and Spacing shall conform to the following table:

<u>Pipe Sizes</u>	<u>Spacing</u>	<u>Rods</u>
2 Inch and Smaller	6 Feet	3/8 Inch
2-1/2 Inch to 3 Inch	8 Feet	1/2 Inch
4 Inch and larger	8 Feet	5/8 Inch

H. Hangers and Supports shall be adequate to maintain alignment and prevent sagging and shall be placed within 18 inches of joint. Support shall be provided at each horizontal branch connection.

I. Provide lateral bracing as manufactured by B-Line or approved equal for all piping to prevent swaying or movement in accordance with SMACNA "Guidelines for Seismic Restraints of Piping Systems". Piping smaller than indicated in the guidelines shall be provided with bracing as specified for the smallest size indicated. The entire water distribution system shall be properly braced and will not move due to the action of quick closing of valves.

J. Miscellaneous Supports, Wall Brackets, Etc.: Provide where required in accordance with the best standard practices of the trade. Submit shop drawings for all fabricated supports.

2.2 Isolators. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator. Isolators shall be B-Line vibra clamp and cushion, Super Strut, Stoneman "Trisolator", or approved equal. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.

2.3 Shields:

A. General: Provide shields at piping hangers and supports, factory-fabricated, for all insulated piping as manufactured by Pipeshields Incorporated or approved equal. Size shields for exact fit to mate with pipe insulation.

1. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation or equal 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of

the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.4 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.5 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ERICO International Corporation.
2. PHS Industries, Inc.
3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
4. Piping Technology & Products, Inc.

- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.

- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 22 05 29

SECTION 22 05 53**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Valve tags.
 5. Warning tags.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
1. C.C.R., Title 24, Part 5 (2022 CPC).
 2. 2022 California Plumbing Code.
 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California State Division of Industrial Safety.
 6. County Health Department.
 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.
- F. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.

4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

G. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 incheshigh.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.
 - 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
 - 3. Letter Color:
 - a. Cold Water: Black.
 - b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19**PLUMBING PIPING INSULATION****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.
- B. Substitution Requirements:
1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
 5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.11 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.12 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.13 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.14 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.15 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.16 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.17 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.18 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Hot Water Pipe Insulation: All hot water supply and return piping, except exposed connections to plumbing fixtures, flanges and unions shall be insulated with ASTM C547, Class I, "Johns-Manville" "Micro-Lock" 850-APT, Owens-Corning Fiberglass Corp., ASJ/SL-11 or approved equal, 1" thick for sizes up to 1" and 1-1/2" thick for sizes 1 1/4" and larger with "Johns-Manville" "Zeston" pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in

thickness to insulation for piping. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2022 CMC

1. Exposed insulated piping in occupied areas and exposed outside the building shall be covered with Johns-Manville" "Zeston" 30-mil thick white PVC jacketing material per ASTM D1784 with "Johns-Manville" "Zeston" pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Jacketing shall comply with ASTM E84, and shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2022 CMC.
 2. Hot water piping below slab shall have insulation protected by a 10-mil thick polyethylene plastic sleeve sealed watertight with poly vinyl chloride tape.
- B. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- G. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.
 - I. Condensate Pipe Insulation: All condensate piping within the building shall be insulated with "Imcoa" "Imcolock" ¾" nominal wall thickness closed-cell insulation. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2022 CMC. All joints shall be mitered and secured with black duct tape.
 - J. Indirect Waste Pipe Insulation: All indirect waste drains from refrigerated kitchen equipment shall be insulated with "Armacell" "Armaflex" insulating tape.

- K. All insulation shall be continuous through supports and hangers.
- L. All fixtures complying with the provisions of the Americans with Disabilities Act shall be provided with Prowrap insulation for exposed hot water pipe, tailpiece, and trap as manufactured by McGuire, and secured per manufacturers recommendations. No tape wrapping shall be permitted.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive 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."
- C. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive 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."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive 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."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive 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."

2.3 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

2.4 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.5 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers,:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. McGuire Manufacturing.
 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

- a. For below-ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.

- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for

- above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. NPS 1" and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1" inch thick.
2. NPS 1-1/4" and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 1/2" inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
 - a. McGuire pre-insulated trap and supply covers.

END OF SECTION 22 07 19

SECTION 22 11 16**DOMESTIC WATER PIPING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite domestic water system.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of

submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.13 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.14 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
 2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- F. Piping within the building and above grade shall be Type "L" ASTM B88, hard drawn copper tubing with wrought copper sweat fittings ANSI B16.18 and B16.22.
- G. Outdoor underground piping in sizes 2-1/2" and 3" shall be Type "L" ASTM B88, hard drawn copper as specified for water piping within the building. Piping 2" and smaller shall be Type "K" ASTM B88, hard drawn copper with wrought copper sweat fittings ANSI B16.18 and B16.22.
- H. Piping below the building floor shall be Type "K" soft annealed copper tubing with no fittings below the slab.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 VALVE ACCESSORIES AND SPECIALTIES

- A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
 - 1. For service shut-off valves on domestic water; for pressure regulator assemblies, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type

2. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.5 KITCHEN EQUIPMENT & FIXTURES

- A. The Plumbing Contractor shall run all service lines, rough-in and make final connections to all fixtures and equipment provided by Kitchen Equipment Contractor. The work shall include installing and connecting of all sinks, garbage disposals, piping within equipment, through, under or along the backs of working surfaces as required and indicated by equipment manufacturer, Plumbing Contractor shall furnish and install all hot and cold water stops as required for Kitchen Equipment furnished sinks and equipment. The Contractor shall also furnish and install sinks and equipment as indicated on plumbing drawings complete with all required trim including faucets and stops. All exposed piping and fittings shall be chrome plated.

2.6 CORROSION PROTECTION:

1. General.
 - a. Corrosion protection shall be provided for all below grade copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.
2. Materials.
 - a. Copper piping encasement.
 - 1) The polywrap shall be minimum 6 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall conform to the requirements of ASTM D1248.
 - 2) The polywrap shall be as manufactured by Northtown Company or approved equal.
 - b. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

Pipe Size / Type	Polywrap Flat Tube Width
½" to ¾" copper	2"
1" to 1-½" copper	3"
2" copper	4"
2-1/2" copper	5"
3" copper	6"
 - c. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.
 - 1) Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.
 - d. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- D. Install shutoff valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install domestic water piping level without pitch and plumb.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- S. Corrosion Protection:
 - 1. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the poly-wrap. The bunched-up poly-wrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the poly-wrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.
 - 2. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.
 - 3. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2 and Smaller: 72 inches with 3/8-inch rod.
 - 2. NPS 2-1/2 to NPS 3: 8 feet with 1/2-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.5 CONCRETE VAULT INSTALLATION

- A. Install precast concrete vaults according to ASTM C 891.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 PIPE AND EQUIPMENT IDENTIFICATION

- A. Each operating and service line shut-off valve shall be identified by a 19 ga. brass tag with stamped, engraved type of service identified and area served, complete with hole and brass chain mounted on valve stem or handle. Tag shall be a minimum of one and one-half inch (1-1/2") in diameter.
- B. All piping systems shall be readily identifiable by appropriate labeling with the name of the piping contained. Such labeling shall be by means of metal tags, stenciling, stamping, or with adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft and at least once in each room and each story traversed by the piping system.
- C. Provide on exterior wall of each building opposite the building's main gas service a sign reading "Gas Shut Off". Sign shall be metal with minimum 1-1/2" high-embossed letters.
 1. All equipment shall be provided with name plate indicating all pertinent information on it

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

Schedule of Test Pressures:

<u>System Tested</u>	<u>Gauge</u>	<u>Test</u>	<u>Duration</u>
Water	100 PSI	Water	4 Hours

- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Operate all valves during the retention period.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours. Operate all valves during the retention period.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 OPERATION INSTRUCTION

- A. Prior to occupancy or prior to the date of final inspection, whichever may occur first, the Contractor shall prepare two (2) sets of typewritten instructions for the operation of all equipment, valves, etc., specified and furnished as a part of the work under this section, and shall assign a competent person, thoroughly familiar with the job, to demonstrate and instruct a representative of the Owner in the operation of the equipment. The time of said demonstration and instructions shall be arranged with the Owner's representative approximately one (1) week in advance. Verbal instructions shall include shut-off location of gas and water. The Contractor shall assemble all operation and maintenance data supplied by the manufacturers of the various pieces of equipment, all keys and special wrenches required to operate and service the equipment (including keys for yard boxes, gas stops and fixture stops), and all equipment warranties and deliver same to the representative of the Owner on date of said instructions.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

SECTION 22 11 19**DOMESTIC WATER PIPING SPECIALTIES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Balancing valves.
 - 4. Temperature-actuated, water mixing valves.
 - 5. Hose bibbs.
 - 6. Water-hammer arresters.
 - 7. Trap-seal primer valves.
 - 8. Trap-seal primer systems.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative

before proceeding with this work.

- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite domestic water system.
- E. Domestic Water Service: The Contractor shall arrange with the serving utility company for the installation of all water meter assemblies and reduced pressure backflow devices, including the service mains and vaults, and all required appurtenances as indicated on the drawings and in accordance with serving utility standards and shall pay all costs incurred. All required capacity fees, frontage fees and inspections, shall be paid for by the Owner. Contractor shall provide necessary tap-in connections in water main for sterilizing of domestic water system. Contractor shall connect into the main water service line as indicated on the drawings. The installation shall be in accordance with the serving utility company's standards.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.

- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.14 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include

locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.15 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.16 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1001.
4. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - b. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - c. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
 - d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
3. Standard: ASSE 1011.
4. Body: Bronze, nonremovable, with manual drain.
5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
6. Finish: Rough bronze.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
3. Standard: ASSE 1020.
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 5 psig maximum, through middle third of flow range.
6. Size: See plans.
7. Design Flow Rate: See plans.
8. Selected Unit Flow Range Limits: See plans.
9. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - b. Woodford Manufacturing Company; a division of WCM Industries, Inc.

- c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
- 3. Standard: ASSE 1035.
- 4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10) matching faucet size.
- 5. Body: Bronze.
- 6. End Connections: Threaded.
- 7. Finish: Chrome plated.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - b. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
- 3. Standard: ASSE 1012.
- 4. Operation: Continuous-pressure applications.
- 5. Size: See plans.
- 6. Body: Bronze.
- 7. End Connections: **[Union, solder] [Solder]** joint.
- 8. Finish: Rough bronze.

B. Beverage-Dispensing-Equipment Backflow Preventers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - b. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
- 3. Standard: ASSE 1022.
- 4. Operation: Continuous-pressure applications.
- 5. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).
- 6. Body: Stainless steel.
- 7. End Connections: Threaded.

C. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Standard: ASSE 1032.
4. Operation: Continuous-pressure applications.
5. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).
6. Body: Stainless steel.
7. End Connections: Threaded.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. NIBCO Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
3. Type: Ball valve with two readout ports and memory-setting indicator.
4. Body: Brass or bronze.
5. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
6. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. NIBCO Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
3. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
4. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Symmons Industries, Inc.
 - b. Bradley.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig (860 kPa).
5. Type: Thermostatically controlled, water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded[**union**] inlets and outlet.
8. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Tempered-Water Setting: 120°F.
10. Tempered-Water Design Flow Rate: 0.35 GPM.
11. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Symmons Industries, Inc.
 - b. Bradley.
3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
5. Type: Exposed-mounted or Cabinet-type (Refer to Plumbing Fixture Schedule), thermostatically controlled, water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded[**union**] inlets and outlet.
8. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Tempered-Water Setting: 120°F.
10. Tempered-Water Design Flow Rate: 0.35 GPM.
11. Selected Valve Flow Rate at 45-psig (310-kPa) Pressure Drop: 0.35 GPM.
12. Valve Finish: Rough bronze.
13. Piping Finish: Copper.
14. Cabinet: Factory fabricated, stainless steel, for recessed or surface (Refer to Plumbing Fixture Schedule) mounting and with hinged, stainless-steel door.

C. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Symmons Industries, Inc.
 - b. Bradley.
3. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
4. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded.
8. Finish: Rough or chrome-plated bronze.
9. Tempered-Water Setting: 110°F.
10. Tempered-Water Design Flow Rate: 0.35 GPM.

D. Primary Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Symmons Industries, Inc.
 - b. Bradley.
3. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
4. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
5. Body: Bronze.
6. Temperature Control: Manual.
7. Inlets and Outlet: Threaded.
8. Selected Primary Water Tempering Valve Size: See plans.
9. Tempered-Water Setting: 120°F.
10. Tempered-Water Design Flow Rate: See plans.
11. Tempered-Water Outlet Size: See plans for end connection.
12. Cold-Water Inlet Size: See plans for end connection.
13. Hot-Water Inlet Size: See plans for end connection.
14. Valve Finish: Rough bronze.

2.7 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. Symmons Industries, Inc.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - f. Whitehall Manufacturing; a div. of Acorn Engineering Company.
 - g. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
3. Mounting: Recessed.
4. Material and Finish: Plastic box and faceplate.
5. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
6. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
7. Drain: NPS 2 (DN 50) standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.

9. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Acorn Engineering Company.
 - b. IPS Corporation.
3. Mounting: Recessed.
4. Material and Finish Plastic box and faceplate.
5. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
6. Supply Shutoff Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Include operating key with each operating-key hose bibb.

2.9 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products, Inc.
 - b. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.11 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products, Inc.
2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Four.
8. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water-hammer arresters in water piping according to PDI-WH 201.
- B. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- C. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 Access Panels:

- A. Wall access panels shall be minimum 12" x 12" for concealed valves and other equipment unless otherwise specified or indicated. Ceiling access panels shall be 18" x 18" minimum. Access panels shall be located and positioned for ready access and service of equipment housed within. Where access panels are specified with keyed cylinder locks, all such locks shall be identically keyed.
 - 1. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-CL, drywall, stainless steel finish, cylinder lock.
 - 2. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
 - 3. Wall, Fire Rated: Elmdor/Stoneman FR-SS-CL, fire rated, stainless steel finish, cylinder lock.
 - 4. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.
 - 5. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-AKL, drywall, stainless steel finish, allen key latch.
 - 6. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
 - 7. Wall, Fire Rated: Elmdor/Stoneman FR-SS, fire rated, stainless steel finish, return latch.
 - 8. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.

- 3.3 Yard Boxes & Vaults: For service shut-off valves on gas and domestic water; for pressure regulator assemblies and for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

3.4 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.5 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Supply-type, trap-seal primer valves.
 - 2. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

3.7 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

SECTION 22 13 16**SANITARY WASTE AND VENT PIPING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Sanitary Sewer: The Contractor shall be responsible for the soil and waste piping outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite sewer system.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.

- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without

proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.14 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.15 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
 2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

1.16 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.17 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.18 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. ASTM C 1540, Heavy Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky SD 4000 series.
 - b. MIFAB MI-QXHUB.
 - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

- C. Soil and waste piping within the building itself and outside within five feet (5') of the foundation, shall be no-hub cast iron pipe and fittings, asphaltum coated, free from defects, and shall comply with CISPI. Standard 301, ASTM A-888 or ASTM A-74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Fittings shall be made up with "Husky" SD 4000 series or "MIFAB MI-QXHUB" series stainless steel type 304 couplings and shall conform to ASTM C1540 & ASTM C564 except all above ground vent pipe fittings may be made with "Anaco" or "MIFAB" stainless steel two band couplings conforming to CISPI Standard 310.
- D. Except where otherwise indicated on the plans, building sewer piping from five feet (5') outside of the building to connections at the sewer shall be PVC (polyvinyl chloride) ASTM D3034, SDR-35 sewer pipe with locked-in gasket (ASTM F477, Elastomeric Seal).
- E. Grease waste piping underground shall be cast iron pipe and fittings as specified for soil and waste piping.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:

- 1. Cleanouts to Grade: Jay R. Smith No. 4258 or Jay R. Smith No. 4253 with X-H bronze plug and X-X-H non-skid cover with lifting device set flush with surface for concrete areas. Asphalt or nonsurfaced areas shall be installed with ring of concrete poured around the bottom flange six inches (6") below surface. Use cast iron soil pipe on cleanout risers. For cleanouts in non-traffic areas, terminate cleanout plug in concrete yard box
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.
 - b. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- 3. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
- 4. Top-Loading Classification(s): Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty.
- 5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

- B. Yard Boxes & Vaults: For service for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

2.4 CORROSION PROTECTION

A. General.

1. Corrosion protection shall be provided for all below grade cast iron and copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

B. Materials.

1. Cast iron piping encasement.
 - a. The polywrap shall be minimum 8 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall meet or exceed the requirements of AWWA C105, ANSI A21.5 and ASTM A674.
 - b. The polywrap shall be as manufactured by Northtown Company or approved equal.
2. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

<u>Pipe Size / Type</u>	<u>Polywrap Flat Tube Width</u>
2" to 3" cast iron	14"
4" cast iron	16"
6" cast iron	20"
8" cast iron	24"
3. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.
 - a. Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.
4. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- T. Kitchen Equipment & Fixtures:
 - 1. The Plumbing Contractor shall run all service lines, rough-in and make final connections to all fixtures and equipment provided by Kitchen Equipment Contractor. The work shall include installing and connecting of all sinks, garbage disposals, drain lines, piping within equipment, through, under or along the backs of working surfaces as required and indicated by equipment manufacturer, Plumbing Contractor shall furnish and install all tailpieces, P-traps, as required for Kitchen Equipment furnished sinks and equipment. The Contractor shall also furnish and install sinks and equipment as indicated on plumbing drawings complete with all required trim including P-trap and strainers. The Plumbing Contractor shall also furnish and install all required vents from traps, and all required indirect waste lines. All exposed piping and fittings shall be chrome plated, with the exception of drain line and P-trap serving garbage disposals that are larger than 2-inch in size. Sizes larger than 2 inch shall have type L copper drain and copper P-trap compete with union connections.
- U. Below-grade piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts and sleeves as manufactured by Century Line.
- V. Corrosion Protection:
 - a. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the polywrap. The bunched-up polywrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the polywrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and

the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

- b. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.
- c. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.

5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. No piping work shall be concealed or covered until piping has been tested, inspected and approved by the Inspector. All piping for plumbing systems shall be completely installed and tested as required by the California Plumbing Code. Test pressures and times indicated are a minimum only. All tests shall be as required by the governing authority as well. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- C. Aboveground, vent piping shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Underground, soil, waste, and vent piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION 22 13 16

SECTION 22 13 19**SANITARY WASTE PIPING SPECIALTIES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Cleanouts.
- 2. Floor drains.
- 3. Miscellaneous sanitary drainage piping specialties.
- 4. Grease interceptors.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. HDPE: High-density polyethylene plastic.

1.4 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.5 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.

6. County Health Department.
7. Any other legally constituted body-having jurisdiction thereof.

- B. 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 Owner's representative.

1.6 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.7 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
1. Grease interceptors.
- B. Submittal Requirements:
1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 3. 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.
 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.
- C. Substitution Requirements:
1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the

contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

- a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
 5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that grease interceptors, accessories, and components will withstand seismic forces defined in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.14 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.15 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- 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.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.16 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.17 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.18 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.19 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate size and location of roof penetrations.

1.20 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. bottles.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping

4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Threaded.
7. Closure: Brass plug with tapered threads.
8. Adjustable Housing Material: Cast iron with set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Option for drilled-and-threaded plug in first subparagraph below is for a screw for a wall cover plate.
6. Closure: Countersunk, brass plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
9. Wall Access: stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
3. Standard: ASME A112.6.3.
4. Pattern: Floor drain.
5. Body Material: Gray iron.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Outlet: Bottom.
10. Coating in first subparagraph below is usually used only on sanitary floor drains.
11. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
12. Sediment Bucket: Not required.
13. Top or Strainer Material: Nickel bronze.
14. Top of Body and Strainer Finish: Nickel bronze.
15. Top Shape: Round.

B. Stainless-Steel Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Josam Company.
3. Standard: ASME A112.3.1.
4. Outlet: Bottom.
5. Top or Strainer Material: Stainless steel.
6. Top Shape: Round.
7. Trap-Primer Connection: Required.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.4 GREASE INTERCEPTORS

A. Grease Interceptors:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Jensen Precast.
3. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation or -processing wastewater.
4. PDI certification is currently limited to 50-gpm (3.15-L/s) flow rate and 100-lb (45.4-kg) grease retention by PDI-G101. Larger uncertified units are available. PDI-G101 is being revised, should be available by end of 2003, and will include capacities to 100 gpm (6.3 L/s).
5. Plumbing and Drainage Institute Seal: Not required.
6. Rate in subparagraph below is limited to 100 gpm (6.3 L/s).
7. Capacity in first subparagraph below is limited to 200 lb (90.7 kg).
8. Grease Retention Capacity: 750 Gallon.
9. Inlet and Outlet Size: 4"
10. Cleanout: Integral or field installed on outlet.
11. Mounting: Recessed, flush with floor.
12. Operation: Manual cleaning.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Install grease interceptors on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete." Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment"
3. Comply with requirements for vibration isolation devices specified in Section 22 05 48.13 "Vibration Controls for Plumbing Piping and Equipment."

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- Q. Install grease interceptors, venting according to authorities having jurisdiction and with clear space for servicing.
 - 1. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor
 - 2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- R. Install wood-blocking reinforcement for wall-mounting-type specialties.

- S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 62 00 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Grease interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 22 13 19

SECTION 22 14 13**STORM DRAIN PIPING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.
 2. Storm Drainage, Force-Main Piping: 150 psig.
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.

- D. Storm Drain: The Contractor shall be responsible for the storm drain service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite storm drain system.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

- b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
- 5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.14 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.15 PROJECT CONDITIONS

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of storm-drainage service.

2. Do not proceed with interruption of storm-drainage service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky SD 4000 series.
 - b. MIFAB MI-QXHUB.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Storm Drain Piping:
 1. Concealed storm drain piping within the building itself and outside within five feet (5') of the foundation, shall be no-hub cast iron pipe and fittings, asphaltum coated, free from defects, and shall comply with CISPI. Standard 301, ASTM A-888 or ASTM A-74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Fittings shall be made up with "Husky" SD 4000 series or "MIFAB MI-QXHUB" series stainless steel type 304 couplings and shall conform to ASTM C 1540 & ASTM C564.
 2. Exposed storm drain piping shall be Schedule 40 galvanized steel pipe, ASTM A53, with black cast iron recessed drainage fittings.
- D. Sub-soil Drainage System:
 1. Piping: PVC, SDR-35 perforated pipe with solid wall fittings and solvent-cemented joints. Perforations shall be 1/4" diameter on 3" centers, 120 degrees between two rows parallel to pipe axis. Install per pipe manufacturer's directions.

2.3 CLEANOUTS

- A. Cast-Iron Cleanouts:

1. Cleanouts to Grade: Jay R. Smith No. 4258 or Jay R. Smith No. 4253 with X-H bronze plug and X-X-H non-skid cover with lifting device set flush with surface for concrete areas. Asphalt or nonsurfaced areas shall be installed with ring of concrete poured around the bottom flange six inches (6") below surface. Use cast iron soil pipe on cleanout risers. For cleanouts in non-traffic areas, terminate cleanout plug in concrete yard box
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.
 - b. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
 3. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 4. Top-Loading Classification(s): Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty.
 5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. Yard Boxes & Vaults: For service for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

2.4 CORROSION PROTECTION:

1. General.
 - a. Corrosion protection shall be provided for all below grade cast iron piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.
2. Materials.
 - a. Cast iron piping encasement.
 - 1) The polywrap shall be minimum 8 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall meet or exceed the requirements of AWWA C105, ANSI A21.5 and ASTM A674.
 - 2) The polywrap shall be as manufactured by Northtown Company or approved equal.
 - b. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

Pipe Size / Type	Polywrap Flat Tube Width
2" to 3" cast iron	14"
4" cast iron	16"

6" cast iron	20"
8" cast iron	24"
10" cast iron	27"
12" cast iron	30"
15" cast iron	37"

- c. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.
 - 1) Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.
- d. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.

- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 1% downward in direction of flow for piping NPS 3 and smaller; 1% downward in direction of flow for piping NPS 4 and larger unless noted otherwise on drawings.
 - 2. Horizontal Storm-Drainage Piping: 1% downward in direction of flow unless noted otherwise on drawings.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- O. Install steel piping according to applicable plumbing code.
- P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- Q. Install engineered siphonic drain specialties and storm drainage piping in locations indicated.
- R. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- S. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- T. Install force mains at elevations indicated.
- U. Plumbing Specialties:
 - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure

- plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
 - V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 - W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
 - Z. Corrosion Protection:
 - a. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the polywrap. The bunched-up polywrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the polywrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.
 - b. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.
 - c. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
 - 2. Install backwater valves in accessible locations.
 - 3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 6. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
 - 8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3 : 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

- C. Connect storm drainage piping to roof drains and storm drainage specialties.
 - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
 - 2. Install horizontal backwater valves with cleanout cover flush with floor.
 - 3. Comply with requirements for backwater valves cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- D. Connect force-main piping to the following:
 - 1. Storm Sewer: To exterior force main.
 - 2. Sump Pumps: To sump pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 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.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 14 13

SECTION 22 14 23**STORM DRAIN PIPING SPECIALTIES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Roof drains.
 2. Miscellaneous storm drainage piping specialties.
 3. Cleanouts.
 4. Flashing materials.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
1. C.C.R., Title 24, Part 5 (2022 CPC).
 2. 2022 California Plumbing Code.
 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California State Division of Industrial Safety.
 6. County Health Department.
 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.
 - 2. Storm Drainage, Force-Main Piping: 150 psig.
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to

have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.13 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.14 PROJECT CONDITIONS

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of storm-drainage service.
 2. Do not proceed with interruption of storm-drainage service without Architect's written permission.
- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
 - 3. Standard: ASME A112.6.4, for general-purpose roof drains.
 - 4. Body Material: Cast iron.
 - 5. Dimension of Body: Nominal 15-inch diameter.
 - 6. Combination Flashing Ring and Gravel Stop: Required.
 - 7. Outlet: Bottom.
 - 8. Extension Collars: Required.
 - 9. Underdeck Clamp: Required.
 - 10. Sump Receiver Plate: Required.
 - 11. Dome Material: Cast iron.
 - 12. Perforated Gravel Guard: Stainless steel.
 - 13. Vandal-Proof Dome: Required.
 - 14. Overflow Drain Water Dam: 2 inches.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- A. Downspout Adaptors:
 - 1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
 - 2. Size: Inlet size to match parapet drain outlet.
- B. Downspout Boots:
 - 1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
 - 2. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.
- C. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.3 CLEANOUTS

A. Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts.
3. Standard: ASME A112.36.2M, for adjustable housing cleanouts.
4. Size: Same as connected branch.
5. Type: Adjustable housing.
6. Body or Ferrule Material: Cast iron.
7. Clamping Device Required.
8. Outlet Connection: Spigot.
9. Closure: Cast-iron plug.
10. Adjustable Housing Material: Cast iron with threads
11. Frame and Cover Material and Finish: Stainless steel.
12. Frame and Cover Shape: Round.
13. Top-Loading Classification: Heavy Duty.
14. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Test Tees:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
3. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
4. Size: Same as connected drainage piping.
5. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure Plug: Countersunk.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn
 - b. JR Smith.
 - c. Watts
3. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
4. Size: Same as connected drainage piping.
5. Body Material Hubless, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure: Countersunk or raised-head cast-iron plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
9. Wall Access: Round stainless-steel wall-installation frame and cover.

2.4 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Zurn
 - b. JR Smith.
 - c. Watts
3. Standard: ASME A112.14.1, for backwater valves.
4. Size: Same as connected piping.
5. Body Material: Cast iron.
6. Cover: Cast iron with bolted access check valve.
7. End Connections: hubless.
8. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
9. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. ProSet Systems Inc.
3. Standard: ASTM E 814, for through-penetration firestop assemblies.

4. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
5. Size: Same as connected pipe.
6. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
7. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
8. Special Coating: Corrosion resistant on interior of fittings.

2.6 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Install expansion joints, if indicated, in roof drain outlets.
 3. Position roof drains for easy access and maintenance.
- B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 3. Locate cleanouts at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install test tees in vertical conductors and near floor.
- F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23

SECTION 22 16 16CONDENSATE DRAIN PIPING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Single-Wall Piping Pressure Rating: 10-foot head of water.

- A. Delegated Design: Design seismic restraints for aboveground piping, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.6 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also

protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
- c. Include all pertinent construction, installation, performance and technical data.
- d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were

selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.13 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.14 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
 2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

1.15 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.16 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include

locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.17 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Indirect Waste Piping.
 - 1. Shall be Type "L" copper as specified for water piping.
- C. Air Conditioning Condensate Drain Piping.
 - 1. Shall be Type "M" copper as specified for water piping.

2.2 COPPER TUBE AND FITTINGS:

- A. Hard Copper Tube: ASTM B 88, Type M tube, drawn temper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- C. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends

2.3 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 150 psig.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of condensate drain piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install condensate drain piping with 1 percent slope downward toward drain.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping at indicated slopes.
- G. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Install unions in copper tubing at connection to each piece of equipment, machine, and specialty.

- L. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:

- a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers
- 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
- 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
- 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Specialties: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Install test tees (wall cleanouts) in conductors near floor.
 - 3. Equipment: Connect drainage piping as indicated. Provide union for each connection.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- D. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.6 IDENTIFICATION

- A. Identify exposed condensate drain piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill condensate drain piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

- B. Condensate drain piping will be considered defective if it does not pass tests and inspections

- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, condensate drain piping NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type M copper, solder-joint fittings; and soldered joints.

END OF SECTION 22 16 16

SECTION 22 33 00**ELECTRIC DOMESTIC-WATER HEATERS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the

work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

- 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
 5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
 6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.
- 1.11 UNINSPECTED WORK
- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- 1.12 QUALITY ASSURANCE
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.13 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.14 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.15 WARRANTY

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Two years.
 - b. Compression Tanks: Five years.
 - c.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AO Smith
 - b. Bradford White
 - c. Rheem
 - d. Lochinvar
 2. Standard: UL 1453.
 3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 4. Special Requirements: NSF 5 construction.

2.2 ELECTRIC, TANKLESS, domestic-WATER HEATERS

A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chronomite Laboratories, Inc.
 - b. Rheem
2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
4. Support: Bracket for wall mounting.
5. Capacity and Characteristics:
 - a. Flow Rate: 0.35 GPM.
 - b. Maximum Temperature Setting: 110°.
 - c. Power Demand: 4,160 Watts.
 - d. Electrical Characteristics:
 - 1) Volts: 208.
 - 2) Phases: Single.
 - 3) Hertz: 60.
 - 4) Full-Load Amperes: 20.

B. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chronomite Laboratories, Inc.
 - b. Rheem
2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.

- b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Thermostat.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
- 4. Support: Bracket for wall mounting.
 - 5. Capacity and Characteristics:
 - a. Flow Rate: 0.5 GPM at 57°F temperature rise.
 - b. Temperature Setting: 110 °F.
 - c. Power Demand: 4,160 watts
 - d. Electrical Characteristics:
 - 1) Volts: 120.
 - 2) Phases: Single.
 - 3) Hertz: 60.
 - 4) Full-Load Amperes: 20.

2.3 domestic-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AMTROL Inc.
 - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - c. Taco, Inc.
- 2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.

- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

- C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- F. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- G. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.

3. Arrange units so controls and devices that require servicing are accessible.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

- I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- K. Fill electric, domestic-water heaters with water.
- L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 22 33 00

SECTION 22 42 13 13**COMMERCIAL WATER CLOSETS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Flushometer valves.
 - 3. Toilet seats.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
 - 8. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
 - 9. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
 - 10. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
 - 11. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

12. Accessible fixture controls shall comply with CBC Sections 11B-604.6 for water closets and 11B-604.9.5 for children's water closets.

- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:

- a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
- c. Include all pertinent construction, installation, performance and technical data.
- d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any

part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

- A. Water Closets: Floor mounted, bottom outlet, top spud.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

2.2 WALL-MOUNTED WATER CLOSETS

- A. Water Closets: Wall mounted, top spud.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.

- d. Style: Flushometer valve.
- e. Height: Standard.
- f. Rim Contour: Elongated.
- g. Water Consumption: 1.28 gal. (4.8 L) per flush.
- h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

3. Support:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1) ZURN 1200 SERIES "EZCARY" CARRIERS
- b. Standard: ASME A112.6.1M.
- c. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

2.3 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Sloan Valve Company.
- 2. Standard: ASSE 1037.
- 3. Minimum Pressure Rating: 125 psig (860 kPa).
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Panel Finish: Chrome plated or stainless steel.
- 8. Style: Exposed.
- 9. Consumption: 1.28 gal. (4.8 L) per flush.
- 10. Minimum Inlet: NPS 1 (DN 25).
- 11. Minimum Outlet: NPS 1-1/4 (DN 32).

2.4 TOILET SEATS

A. Toilet Seats:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Bemis Manufacturing Company.
 - b. Olsonite Seat Co.
- 2. Standard: IAPMO/ANSI Z124.5.

3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

- A. Water-Closet Installation:
 1. Install level and plumb according to roughing-in drawings.
 2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
 2. Use carrier supports with waste-fitting assembly and seal.
 3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- C. Flushometer-Valve Installation:
 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
- D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-604.6 for water closets

END OF SECTION 22 42 13 13

SECTION 22 42 13 16**COMMERCIAL URINALS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Urinals.
 - 2. Flushometer valves.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
 - 8. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
 - 9. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
 - 10. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
 - 11. Accessible fixture controls shall comply with CBC Sections 11B-605.4 for urinals.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.

- d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.14 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, siphon jet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard
 - b. Kohler Co.
2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Water saving.
 - f. Spud Size and Location: NPS 3/4 (DN 20); top.
 - g. Outlet Size and Location: NPS 2 (DN 50); back.
 - h. Color: White.
3. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2 (DN 50).
4. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1) ZURN CARRIERS

2.2 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Sloan Valve Company.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.

7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

- A. Urinal Installation:
 1. Install urinals level and plumb according to roughing-in drawings.
 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
 3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
 4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for wall-hung urinals.
 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
 3. Use carriers without waste fitting for urinals with tubular waste piping.
 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
- C. Flushometer-Valve Installation:
 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

3.6 Completion of Installation:

- A. Cleaning and Flushing: Clean all equipment and materials thoroughly. Leave surface to be painted smooth and clean, ready for painting.
- B. Flush each unit of water supply and distribution system thoroughly with clean water at the highest velocities attainable.

- C. Clean all piping, valves, traps, water heaters, fixtures and other devices thoroughly and flush or blow out until free of scale, oil silt, sand, sediment, pipe dope and foreign matter of any kind.

3.7 PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.
- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-605.4 for urinals.

END OF SECTION 22 42 13 16

SECTION 22 42 16 13**COMMERCIAL LAVATORIES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Lavatories.
- 2. Faucets.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
 - 8. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
 - 9. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
 - 10. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
 - 11. Accessible fixture controls shall comply with CBC Sections 11B-611.3 for lavatories and sinks.
 - 12. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC 11B-306 when forward approach is required CBC Sections 11B-606.3 and 11B606.7.

13. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories or sinks. CBC Section 11B-606.5.

B. 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 Owner's representative.

1.5 DRAWINGS

A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:

- a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
- c. Include all pertinent construction, installation, performance and technical data.
- d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this

and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Vitreous china, wall mounted, with back.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Faucet-Hole Location: Top.
 - d. Color: White.
 - e. Mounting Material: Chair carrier.
 3. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier.

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, single-control mixing, commercial, solid-brass valve.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chicago Faucets.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Material: Commercial, solid brass.
 5. Finish: Polished chrome plate.
 6. Mounting Type: Deck, exposed.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chicago
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chicago
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 3/8.
 - 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.

- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."
- G. Point of use mixing valve in cabinet to be recessed in wall, under lavatory.

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-606.4 for lavatories and sinks.
- D. Accessible sinks shall be 6-1/2" deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34" maximum above the finish floor or ground.
- E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

END OF SECTION 22 42 16 13

SECTION 22 42 16 16

COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sinks
 - 2. Service sinks.
 - 3. Sink faucets.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
 - 8. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
 - 9. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
 - 10. Accessible fixture controls shall comply with CBC Sections 11B-611.3 for lavatories and sinks.
 - 11. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC 11B-306 when forward approach is required CBC Sections 11B-606.3 and 11B606.7.

12. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories or sinks. CBC Section 11B-606.5.

- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:

- a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
- c. Include all pertinent construction, installation, performance and technical data.
- d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Equipment and Fixtures:

A. Fixtures:

- 1. See schedule on drawings.

2.2 SINKS

A. Utility Sinks: Stainless steel, counter mounted.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing.
- 2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Type: Ledge back.
 - c. Number of Compartments: One
 - d. Overall Dimensions: 22 by 19 inches
 - e. Metal Thickness: 0.050 inch
 - f. Compartment:
 - 1) Dimensions: See Plumbing Fixture Schedule
 - 2) Drain: Grid with NPS 1-1/2 tailpiece with stopper
 - 3) Drain Location: Centered in compartment.
- 3. Faucet(s): See Plumbing Fixture Schedule
 - a. Number Required: One.
 - b. Mounting: On ledge.

2.3 SERVICE SINKS

A. Service Sinks: Enameled, cast iron, floor mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Commercial Enameling Company (CECO).
 - b. American Standard America.
 - c. Kohler Co.
2. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Style: With front apron and raised back.
 - c. Nominal Size: 28 by 28 inches.
 - d. Color: White.
 - e. Drain: Grid with NPS 3 outlet.
 - f. Rim Guard: Coated wire.

2.4 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: Manual Type, Push Button.
 1. Commercial, Solid-Brass Faucets.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following
 - 1) Chicago Faucets.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Material: Commercial, solid brass.
 5. Finish: Chrome plated.
 6. Maximum Flow Rate:
 - a. Sinks: 1.8 gpm.
 - b. Service Sinks: - gpm
 7. Mounting Type: Back/wall, exposed.
 8. Vacuum Breaker: Required for hose outlet.
 9. Spout Outlet: Hose thread according to ASME B1.20.7.

2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.

- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chicago
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Chicago
- E. Operation: Loose Key.

2.6 SINK WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. McGuire MFG.
 - 2. Size: NPS 1-1/2.
 - 3. Material: Chrome-plated, seamless prewrapped cast-brass trap and swivel elbow, and chrome-plated brass or steel wall flange.

2.7 SERVICE SINK WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 3 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 3.
 - 2. Material: Flat Chrome strainer, cast-brass trap and swivel elbow.

2.8 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.

- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

3.6 Completion of Installation:

- A. Cleaning and Flushing: Clean all equipment and materials thoroughly. Leave surface to be painted smooth and clean, ready for painting.
- B. Flush each unit of water supply and distribution system thoroughly with clean water at the highest velocities attainable.

- C. Clean all piping, valves, traps, water heaters, fixtures and other devices thoroughly and flush or blow out until free of scale, oil silt, sand, sediment, pipe dope and foreign matter of any kind.

3.7 PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.
- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-606.4 for lavatories and sinks.
- D. Accessible sinks shall be 6-1/2" deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34" maximum above the finish floor or ground.
- E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

END OF SECTION 22 42 16 16

SECTION 22 42 23**COMMERCIAL SHOWERS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Individual shower receptors.
 - 2. Shower faucets.
 - 3. Group showers.
 - 4. Grout.

1.1 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.2 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body-having jurisdiction thereof.
 - 8. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
 - 9. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
 - 10. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
 - 11. Accessible fixture controls shall comply with CBC Sections 11B-608.5 for showers.

- B. 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 Owner's representative.

1.1 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.2 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.1 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.2 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.3 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.4 SUBMITTAL DATA

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division

except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. 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.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

C. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.7 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of storm-drainage service.
 2. Do not proceed with interruption of storm-drainage service without Architect's written permission.

PART 2 - PRODUCTS

2.1 SHOWER FAUCETS

- A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.
- B. Shower Faucets Faculty:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Symmons
 - b. Bradley
 - c. Acorn Engineering Company
 - 2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
 - 3. Faucet:
 - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Maximum Flow Rate: 1.5 gpm.
 - e. Mounting: Exposed.
 - f. Operation: Single-handle control.
 - g. Antiscald Device: Integral with mixing valve.
 - h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - 4. Supply Connections: NPS 1/2.
 - 5. Shower Head:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Type: Hand shower with five foot stainless steel hose.
 - c. Shower Head Material: Metallic with chrome-plated finish.
 - d. Spray Pattern: Fixed.
 - e. Integral Volume Control: Required.
 - f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
 - g. Temperature Indicator: Not required.

2.2 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.
- B. Examine walls and floors for suitable conditions where showers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble shower components according to manufacturers' written instructions.
- B. Install showers level and plumb according to roughing-in drawings.
- C. Install water-supply piping with stop on each supply to each shower faucet.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- D. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- E. Set shower receptors in leveling bed of cement grout.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 COMPLETION OF INSTALLATION:

- A. Cleaning and Flushing: Clean all equipment and materials thoroughly. Leave surface to be painted smooth and clean, ready for painting.
- B. Flush each unit of water supply and distribution system thoroughly with clean water at the highest velocities attainable.
- C. Clean all piping, valves, traps, water heaters, fixtures and other devices thoroughly and flush or blow out until free of scale, oil silt, sand, sediment, pipe dope and foreign matter of any kind.

3.4 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.5 ADJUSTING

- A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.6 CLEANING AND PROTECTION

- A. After completing installation of showers, inspect and repair damaged finishes.
- B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

3.7 OPERATION INSTRUCTION

- A. Prior to occupancy or prior to the date of final inspection, whichever may occur first, the Contractor shall prepare two (2) sets of typewritten instructions for the operation of all equipment, valves, etc., specified and furnished as a part of the work under this section, and shall assign a competent person, thoroughly familiar with the job, to demonstrate and instruct a representative of the Owner in the operation of the equipment. The time of said demonstration and instructions shall be arranged with the Owner's representative approximately one (1) week in advance. Verbal instructions shall include shut-off location of gas and water. The Contractor shall assemble all operation and maintenance data supplied by the manufacturers of the various pieces of equipment, all keys and special wrenches required to operate and service the equipment (including keys for yard boxes, gas stops and fixture stops), and all equipment warranties and deliver same to the representative of the Owner on date of said instructions.

END OF SECTION 22 42 23

SECTION 22 47 13**DRINKING FOUNTAINS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes drinking fountains and related components.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. 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 the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2022 CPC).
 - 2. 2022 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California State Division of Industrial Safety.
 - 6. County Health Department.
 - 7. Any other legally constituted body having jurisdiction thereof.
 - 8. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
 - 9. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
 - 10. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains.
- B. 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 Owner's representative.

1.5 DRAWINGS

- A. 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 his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. 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 fixtures 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 Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. 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 all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all 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 his 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 all 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.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. 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.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. 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, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For drinking fountains to include in maintenance manuals.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

- A. Drinking Fountains: Stainless steel, wall mounted.
 - 1. Stainless-Steel Drinking Fountains:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- 1) Elkay Manufacturing Co.
- 2) Haws Corporation.
3. Type Receptor: On horizontal support.
4. Back Panel: Stainless-steel wall plate behind drinking fountain.
5. Bubblers: Two, with adjustable stream regulator, located on deck.
6. Control: Push button.
7. Drain: Grid type with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8 with shutoff valve.
9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
10. Support: ASME A112.6.1M, Type III lavatory carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

- A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.
- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-601.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- D. Accessible sinks shall be 6-1/2" deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34" maximum above the finish floor or ground.
- E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

3.7 PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-601.3 for drinking fountains.
- D. Accessible sinks shall be 6-1/2" deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34" maximum above the finish floor or ground.
- E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

END OF SECTION 22 47 13

SECTION 23 05 29**HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
- B. Related Sections:
 - 1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following: include Product Data for components:
 - 1. Trapeze pipe hangers.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS**2.1 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturers to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 23 05 29

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Elastomeric isolation pads.
 2. Restrained-spring isolators.
 3. Elastomeric hangers.
 4. Spring hangers.
 5. Snubbers.
 6. Restraint channel bracings.
 7. Restraint cables.
 8. Seismic-restraint accessories.
 9. Mechanical anchor bolts.
 10. Adhesive anchor bolts.
 11. Vibration isolation equipment bases.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.

- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control, Inc.
 - e. Mason Industries, Inc.
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation.
 - h. Vibration Mountings & Controls, Inc.
 - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 3. Size: Factory or field cut to match requirements of supported equipment.
 - 4. Pad Material: Oil and water resistant with elastomeric properties.
 - 5. Surface Pattern: Smooth pattern.
 - 6. Infused nonwoven cotton or synthetic fibers.

2.2 RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
 - 1. Manufacturers: Subject to compliance with requirements, products by one of the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control, Inc.
 - e. Mason Industries, Inc.
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation.
 - h. Vibration Mountings & Controls, Inc.
 - 2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
 - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.

- b. Top plate with threaded mounting holes.
 - c. Internal leveling bolt that acts as blocking during installation.
- 3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
- 4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.3 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control, Inc.
 - e. Mason Industries, Inc.
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Mountings & Controls, Inc.
 - 2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - 3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.4 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Kinetics Noise Control, Inc.
 - d. Mason Industries, Inc.
 - e. Vibration Eliminator Co., Inc.
 - f. Vibration Isolation.
 - g. Vibration Mountings & Controls, Inc.
 - 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - 9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.5 SNUBBERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control, Inc.
 - 2. Mason Industries, Inc.
 - 3. Vibration Mountings & Controls, Inc.
- B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.6 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Unistrut.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.7 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control, Inc.
 - 2. Loos & Co., Inc.
 - 3. Vibration Mountings & Controls, Inc.
- B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.8 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. TOLCO.
- B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.9 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hilti, Inc.
 - 3. Kinetics Noise Control, Inc.
 - 4. Mason Industries, Inc.
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.10 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. California Dynamics Corporation.
 - 2. Kinetics Noise Control.
 - 3. Mason Industries, Inc.
 - 4. Vibration Eliminator Co., Inc.
 - 5. Vibration Isolation.
 - 6. Vibration Mountings & Controls, Inc.
- B. Steel Rails: Factory-fabricated, welded, structural-steel rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- C. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- D. Concrete Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - 4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturers.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are

- encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
- 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in 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.
- 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
- 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - 9. Test and adjust restrained-air-spring isolator controls and safeties.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.7 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

END OF SECTION 230548

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Duct labels.
 5. Stencils.
 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Black.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, manufacturer, model number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, and as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- F. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in other sections.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Refrigerant Piping:
 - a. Background Color: Orange.
 - b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. All Valve-Tags: 1-1/2 inches minimum, round.
 - 2. Valve-Tag Color:
 - a. All Valve-Tags: Natural.
 - 3. Letter Color:
 - a. All Valve-Tags: Black.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.
- B. TAB Conference: Meet with Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.

- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.9 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 1. Fan Data:
 - a. System identification.

- b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- H. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.10 INSPECTIONS

- A. Initial Inspection:
 - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 - 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - c. Verify that balancing devices are marked with final balance position.
 - d. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner.
 3. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 6. Outdoor, concealed supply and return.
 - 7. Outdoor, exposed supply and return.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Sheet Form Insulation Materials: 12 inches square.
 - 2. Sheet Jacket Materials: 12 inches square.
 - 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Owens Corning; SOFTR All-Service Duct Wrap.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II,

Grade 6. Tested and certified to provide a [1] [2]-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a [1] [2]-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
 - d. Thermal Ceramics; FireMaster Duct Wrap.
 - e. 3M; Fire Barrier Wrap Products.
 - f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive 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."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive 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."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - b. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - c. Mon-Eco Industries, Inc.; 44-05.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants 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."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.9 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015-inch-thick, 1/2 inch wide with wing seal or closed seal.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 3. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

2.11 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Outdoor, concealed supply and return.
 - 6. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, supply-air duct and plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
- B. Concealed, return-air duct and plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.

- C. Concealed, outdoor-air duct and plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
- D. Exposed, supply-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- E. Exposed, return-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- F. Exposed, outdoor-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Outdoor, supply-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- C. Outdoor, return-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- D. Outdoor, outdoor-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."

END OF SECTION 230713

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors and outdoors.
 - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."
 - 2. Section 230716 "HVAC Equipment Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Super-Stik.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive 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."
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive 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."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
- 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
- 4. Service Temperature Range: 0 to plus 180 deg F.
- 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants 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. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants 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."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

- c. RPR Products, Inc.; Insul-Mate.
- 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.

- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape

insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 1. None.
- D. Piping, Exposed:

1. None.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 1. None.
- D. Piping, Exposed:
 1. Painted Aluminum, Corrugated: 0.024 inch thick.

3.14 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type L.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8.

2.2 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoro ethane/Difluoromethane.

PART 3 - EXECUTION**3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A**

- A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- L. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Liquid lines may be installed level.
- M. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 4. Spring hangers to support vertical runs.
 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 1. Comply with ASME B31.5, Chapter VI.
 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 4. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Verify that compressor oil level is correct.
 - 2. Open compressor suction and discharge valves.
 - 3. Open refrigerant valves except bypass valves that are used for other purposes.
 - 4. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 23 31 13 METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Duct liner.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.
 - 7. Seismic-restraint devices.
- B. Related Sections:
 - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Seismic-restraint devices.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant

- coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive 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. Insulation Pins and Washers:
 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 11. 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."
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. 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."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

- F. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Ductmate Industries, Inc.
 - 3. Hilti Corp.
 - 4. Mason Industries.
 - 5. TOLCO; a brand of NIBCO INC.
 - 6. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by the Office of Statewide Health Planning and Development for the State of California.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum

Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply, Return, Outdoor Air, Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.
- B. Supply Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
- F. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
- G. Liner:
 - 1. Supply and Return Air Ducts and Plenums: Fibrous glass, Type I, 1-1/2 inches thick.
 - 2. Transfer Ducts: Fibrous glass, Type I, 2 inches thick.
- H. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- I. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Backdraft and pressure relief dampers.
 2. Barometric relief dampers.
 3. Manual volume dampers.
 4. Flange connectors.
 5. Turning vanes.
 6. Remote damper operators.
 7. Duct-mounted access doors.
 8. Flexible connectors.
 9. Flexible ducts.
 10. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff.
 - 3. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2500 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: Hat-shaped, 18-gage galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked.
- I. Blade Axles:
 - 1. Material: Plated steel.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Synthetic pivot bushings.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Chain pulls.
 - 4. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 5. Screen Mounting: Rear mounted.
 - 6. Screen Material: Galvanized steel.
 - 7. Screen Type: Bird.
 - 8. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff.
 - 3. Ruskin Company.
- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: Hat-shaped, 16-gage, galvanized sheet steel with welded corners or mechanically attached and mounting flange.
- F. Blades:
 - 1. Multiple, 0.025-inch- thick, roll-formed aluminum.
 - 2. Maximum Width: 6 inches.
 - 3. Action: Parallel.
 - 4. Balance: Gravity.
 - 5. Eccentrically pivoted.
- G. Blade Seals: Vinyl.
- H. Blade Axles: Plated steel.
- I. Tie Bars and Brackets:
 - 1. Material: Galvanized steel.
 - 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Bearings: Ball.
- L. Accessories:
 - 1. Flange on intake.
 - 2. Adjustment device to permit setting for varying differential static pressures.

2.5 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nailor Industries Inc.
 - b. Pottorff.
 - c. Ruskin Company.
 - d. Trox USA Inc.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 20-gage, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 6. Blade Axles: Plated steel.
 - 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.

2.6 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.7 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.

2.8 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff.
 - 2. Ventfabrics, Inc.
 - 3. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Galvanized spiral wire sheath.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Recessed.
- F. Wall-Box Cover-Plate Material: Steel.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Pottorff.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.

- e. Fabricate doors airtight and suitable for duct pressure class.
- 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
- C. Pressure Relief Access Door:
 - 1. Door and Frame Material: Galvanized sheet steel.
 - 2. Door: Single wall or double wall with insulation fill with metal thickness applicable for duct pressure class.
 - 3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 - 4. Factory set.
 - 5. Doors close when pressures are within set-point range.
 - 6. Hinge: Continuous piano.
 - 7. Latches: Cam.
 - 8. Seal: Neoprene or foam rubber.
 - 9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 11-gage carbon steel.
- D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 1. Minimum Weight: 14 oz./sq. yd..
 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg F.
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.12 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, polyethylene film supported by helically wound, galvanized-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 5500 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:
 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers rigidly.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 1. On both sides of duct coils.
 2. Upstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. At each change in direction and at maximum 50-foot spacing.
 8. Upstream from turning vanes.
 9. Upstream or downstream from duct silencers.
 10. Control devices requiring inspection.
 11. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
 1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- P. Connect flexible ducts to metal ducts with draw bands.
- Q. Install duct test holes where required for testing and balancing purposes.
- R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Centrifugal roof ventilators.
 - 2. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. Aerovent; a division of Twin City Fan Companies, Ltd.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
 - 1. Doanblast Units: Provide spun-aluminum discharge baffle to direct discharge air downward.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
 - 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 - 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: As required to maintain 12" above finish roof.
 - 3. Sound Curb: Curb with sound-absorbing insulation.
 - 4. Pitch Mounting: Manufacture curb for roof slope.
 - 5. Metal Liner: Galvanized steel.

2.2 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. Aerovent; a division of Twin City Fan Companies, Ltd.
- B. Housing: Steel, lined with acoustical insulation.

- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Plastic or painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
 - 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
 - 6. Filter: Washable aluminum to fit between fan and grille.
 - 7. Isolation: Rubber-in-shear vibration isolators.
 - 8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. Aerovent; a division of Twin City Fan Companies, Ltd.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 3. Companion Flanges: For inlet and outlet duct connections.
 - 4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
 - 6. Vibration Isolators:
 - a. Type: Spring hangers.
 - b. Static Deflection: 1 inch.

2.4 MOTORS

- A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.5 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 23 37 13
AIR DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Modular core, square ceiling diffusers.
 2. Perforated diffusers.
 3. Linear slot diffusers.
- B. Related Sections:
1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
1. Ceiling suspension assembly members.
 2. Method of attaching hangers to building structure.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 5. Duct access panels.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Modular Core, Square Ceiling Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
 2. Devices shall be specifically designed for variable-air-volume flows.
 3. Material: Steel.
 4. Finish: Baked enamel, color selected by Architect.
 5. Face Style: Modular Core.
 6. Mounting: Surface.
 7. Pattern: Adjustable.
- B. Perforated Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Price Industries.
- b. Titus.
- c. Anemostat Products; a Mestek company.
- 2. Devices shall be specifically designed for variable-air-volume flows.
- 3. Material: Steel.
- 4. Finish: Baked enamel, color selected by Architect.
- 5. Duct Inlet: Square.
- 6. Face Style: Flush.
- 7. Mounting: T-bar.
- 8. Pattern Controller: Adjustable with louvered pattern modules at inlet.

2.2 CEILING LINEAR SLOT OUTLETS

- A. Linear Slot Diffuser:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
 - 2. Devices shall be specifically designed for variable-air-volume flows.
 - 3. Material - Shell: Aluminum.
 - 4. Material - Pattern Controller: Steel.
 - 5. Finish: Baked enamel, color selected by Architect.
 - 6. Slot Width: As indicated on plans.
 - 7. Number of Slots: As indicated on plans.
 - 8. Length: As indicated on plans.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 23 74 13**PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Heat-pump refrigeration components.
 - 3. Economizer outdoor- and return-air damper section.
 - 4. Integral, space temperature controls.
 - 5. Roof curbs.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
 - 3. Roof curbs and flashing.

- B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.
- E. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fan Belts: One set for each belt-driven fan.
 - 2. Filters: One set of filters for each unit.

1.8 QUALITY ASSURANCE

- A. ARI Compliance:
 - 1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
 - 1. Comply with ASHRAE 15 for refrigeration system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- E. UL Compliance: Comply with UL 1995.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carrier Corporation.
 2. Trane; American Standard Companies, Inc.
 3. YORK International Corporation.

2.2 CASING

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 1. Exterior Casing Thickness: 0.052 inch thick.
- C. Inner Casing Fabrication Requirements:
 1. Inside Casing: Galvanized steel, 0.034 inch thick.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 1. Materials: ASTM C 1071, Type I.
 2. Thickness: 1/2 inch
 3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 4. Liner Adhesive: Comply with ASTM C 916, Type I.
- E. Condensate Drain Pans: Formed sections of galvanized steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.
 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 2. Drain Connections: Threaded nipple.
 3. Pan-Top Surface Coating: Corrosion-resistant compound.
- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

- A. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
- D. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

2.4 COILS

- A. Supply-Air Refrigerant Coil:
 - 1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Coil Split: Interlaced.
 - 4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1.
- B. Hot-Gas Reheat Refrigerant Coil:
 - 1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.5 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.
- B. Refrigeration Specialties:
 - 1. Refrigerant: R-410A.
 - 2. Expansion valve with replaceable thermostatic element.
 - 3. Refrigerant filter/dryer.
 - 4. Manual-reset high-pressure safety switch.
 - 5. Automatic-reset low-pressure safety switch.
 - 6. Minimum off-time relay.
 - 7. Automatic-reset compressor motor thermal overload.
 - 8. Brass service valves installed in compressor suction and liquid lines.
 - 9. Low-ambient kit high-pressure sensor.
 - 10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
 - 11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
 - 12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.6 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - 1. Pleated: Minimum 90 percent arrestance, and MERV 13.

2.7 DAMPERS

- A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 - 1. Damper Motor: Modulating with adjustable minimum position.
 - 2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.8 ELECTRICAL POWER CONNECTION

- A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.9 CONTROLS

- A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC."

- B. Basic Unit Controls:
 1. Control-voltage transformer.
 2. Wall-mounted thermostat or sensor with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Exposed set point.
 - g. Exposed indication.
 - h. Degree F indication.
 - i. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.
 3. Remote Wall-Mounted Annunciator Panel for Each Unit:
 - a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
 - c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
- C. DDC Controller:
 1. Controller shall have volatile-memory backup.
 2. Safety Control Operation:
 - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
 - b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."
 - c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.
 3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
 4. Unoccupied Period:
 - a. Heating Setback: 50 deg F.
 - b. Cooling Setback: System off.
 - c. Override Operation: Two hours.
 5. Supply Fan Operation:
 - a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
 6. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
 - c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
 7. Hot-Gas Reheat-Coil Operation:
 - a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
 - b. Unoccupied Periods: Reheat not required.
 8. Gas Furnace Operation:
 - a. Occupied Periods: Modulate burner to maintain room temperature.

- b. Unoccupied Periods: Cycle burner to maintain setback temperature.
 - 9. Economizer Outdoor-Air Damper Operation:
 - a. Occupied Periods: Open to minimum position as determined during air balancing procedure to obtain code required minimum outside air quantities. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F. Use outdoor-air temperature to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
 - b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - 10. Carbon Dioxide Sensor Operation:
 - a. Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
 - b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - 11. VVT Relays:
 - a. Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system required in Section 233600 "Air Terminal Units" and Section 230900 "Instrumentation and Control for HVAC."
- D. Interface Requirements for HVAC Instrumentation and Control System:
 - 1. Interface relay for scheduled operation.
 - 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - 3. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
 - d. Monitoring occupied and unoccupied operations.
 - e. Monitoring constant and variable motor loads.
 - f. Monitoring variable-frequency drive operation.
 - g. Monitoring cooling load.
 - h. Monitoring economizer cycles.
 - i. Monitoring air-distribution static pressure and ventilation air volume.

2.10 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Coil guards of painted, galvanized-steel wire.

2.11 ROOF CURBS

- A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1 inch.
 - 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

- c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
- C. Curb Height: 14 inches.
- D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment Mounting:
 - 1. Install RTUs on cast-in-place concrete equipment bases.
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install piping adjacent to RTUs to allow service and maintenance.
 - 1. Gas Piping: Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 1. Inspect for visible damage to unit casing.
 2. Inspect for visible damage to compressor, coils, and fans.
 3. Inspect internal insulation.
 4. Verify that labels are clearly visible.
 5. Verify that clearances have been provided for servicing.
 6. Verify that controls are connected and operable.
 7. Verify that filters are installed.
 8. Clean condenser coil and inspect for construction debris.
 9. Remove packing from vibration isolators.
 10. Inspect operation of barometric relief dampers.
 11. Verify lubrication on fan and motor bearings.
 12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 13. Adjust fan belts to proper alignment and tension.
 14. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
 15. Inspect and record performance of interlocks and protective devices; verify sequences.
 16. Operate unit for an initial period as recommended or required by manufacturer.
 17. Calibrate thermostats.
 18. Adjust and inspect high-temperature limits.
 19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
 21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
 23. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.

- b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
- 24. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.
- 25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 237413

SECTION 23 81 26
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set for each air-handling unit.
 - 2. Gaskets: One set for each access door.
 - 3. Fan Belts: One set for each air-handling unit fan.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000

"Cast-in-Place Concrete."

- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: One year from date of Substantial Completion.
 - c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
 2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
 3. Trane; a business of American Standard companies.
 4. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS OR LESS)

- A. Concealed Evaporator-Fan Components:
1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 2. Insulation: Faced, glass-fiber duct liner.
 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
 5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 7. Filters: Permanent, cleanable.
 8. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - e. Units with stacked coils shall have an intermediate drain pan to collect condensate

from top coil.

B. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - f. Mount unit-mounted disconnect switches on exterior of unit.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Filters: Permanent, cleanable.
7. Condensate Drain Pans:
 - a. Fabricated with **one** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."
- B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - 1. Compressor time delay.
 - 2. 24-hour time control of system stop and start.
 - 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 - 4. Fan-speed selection including auto setting.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- E. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections.
 - 2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 - 3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126